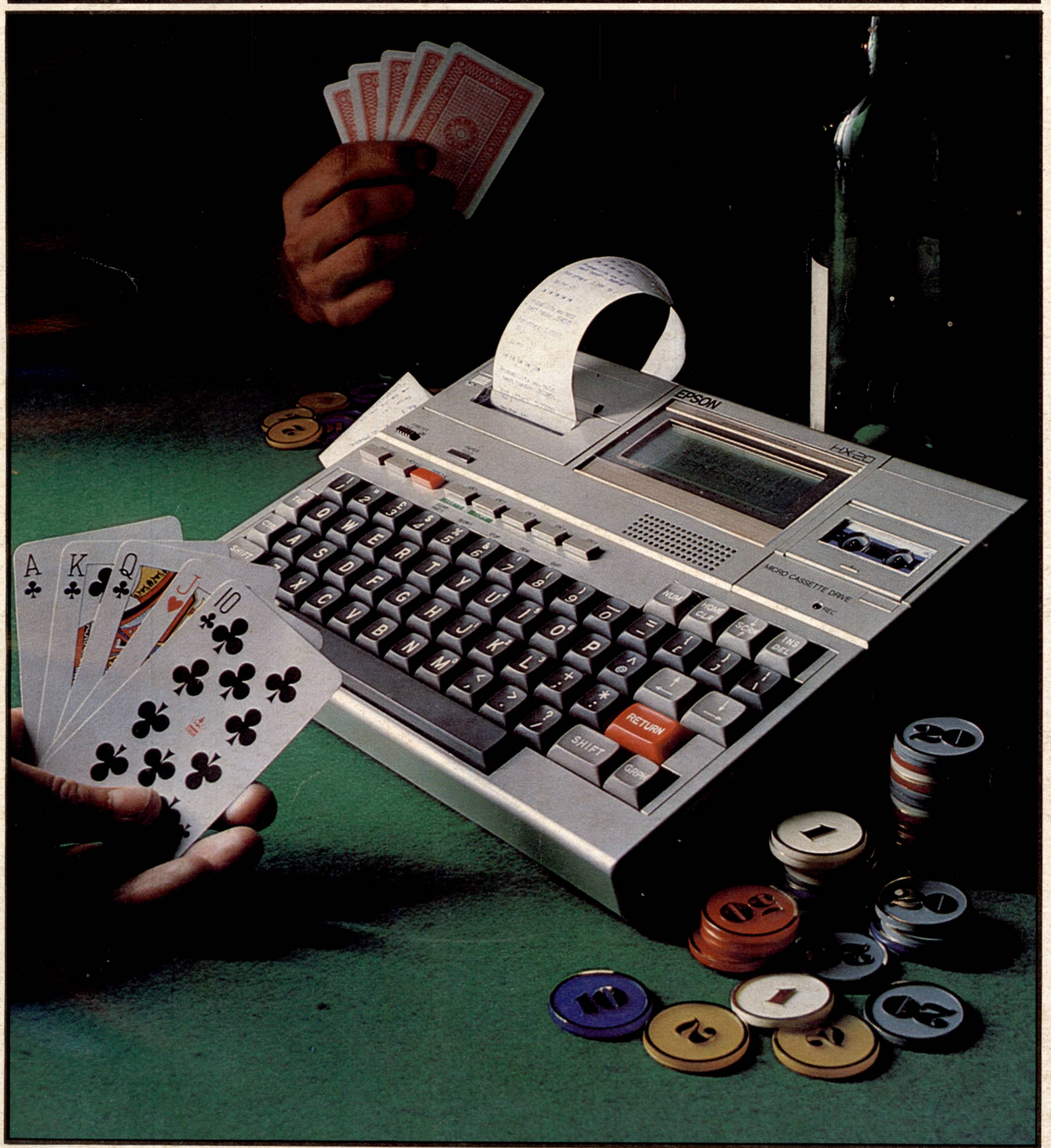
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December 1982 75p

**BRITAIN'S LARGEST SELLING MICRO MAGAZINE**




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## PCW Benchtests the HX20




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| 1 | Introduction to Microcomputers | ☐ Dec 13 | Feb 14 | ☐ |
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| 5 | Fundamentals of BASIC Programming | ☐ Dec 14/15 | Feb 22/23 | ☐ |
| 6 | Improve Your BASIC | ☐ Dec 16/17 | Feb 24/25 | ☐ |
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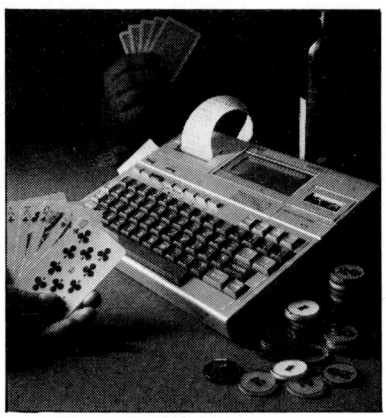
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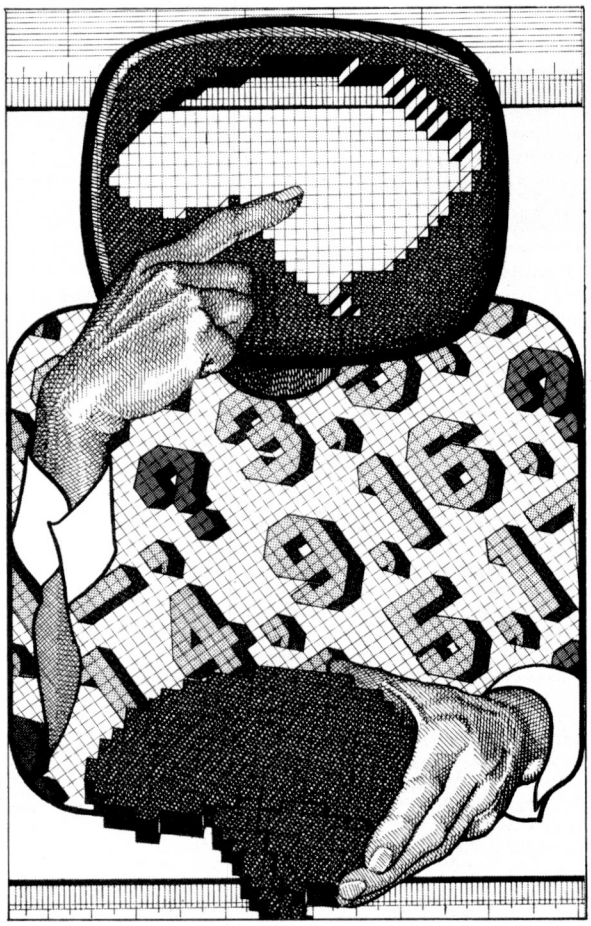
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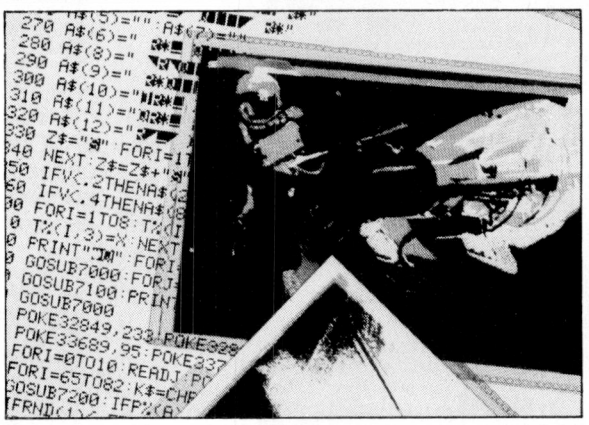
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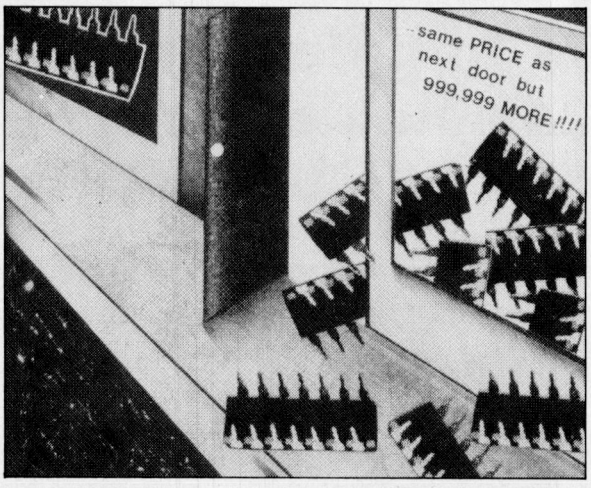
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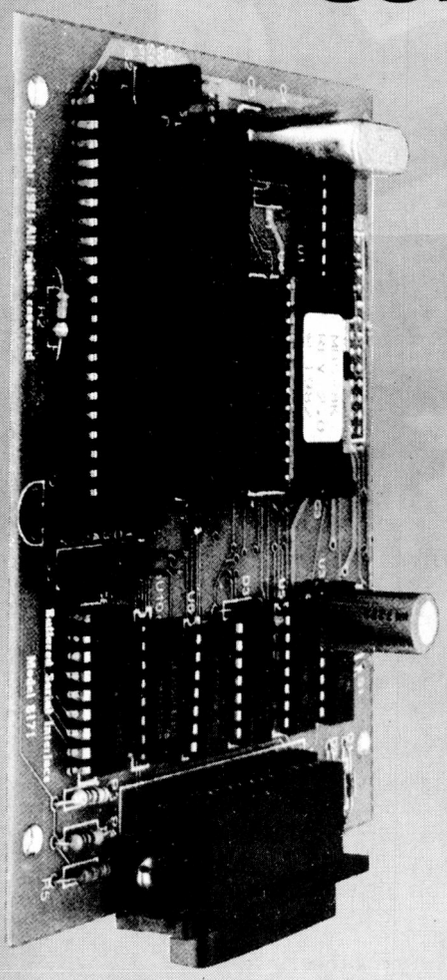


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# HOW TO USE YOUR EPSON WITHOUT WASTING COMPUTER TIME



SERIAL 8K

£125 + VAT

Your computer is capable of sending data at thousands of characters per second but the Epson can only print 80/100 characters per second.

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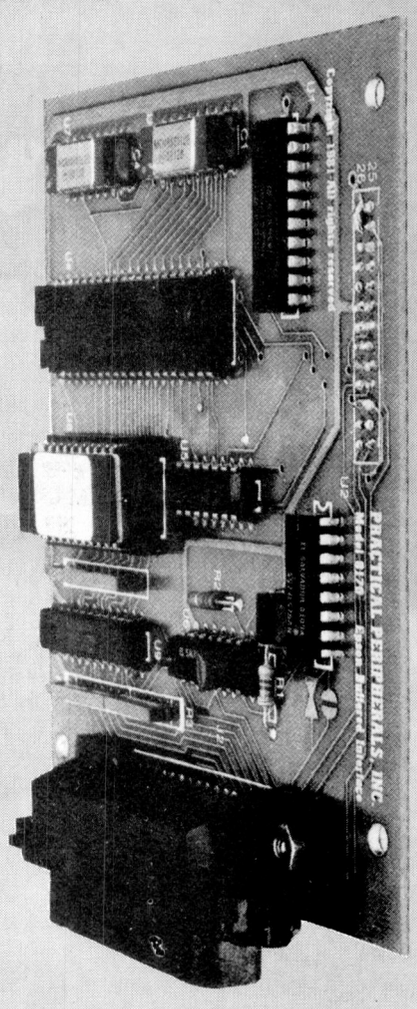
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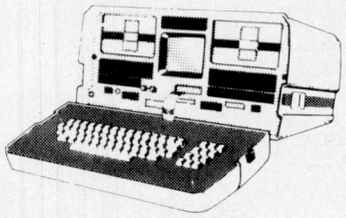
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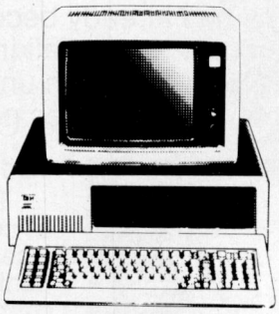
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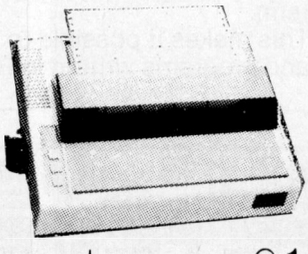


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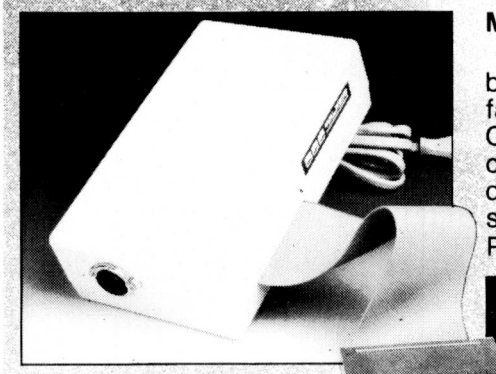


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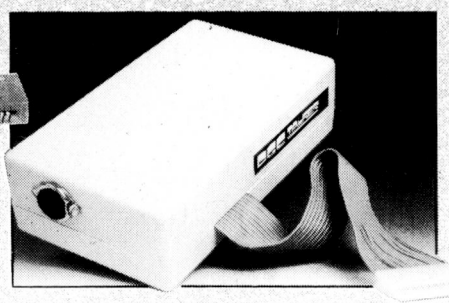


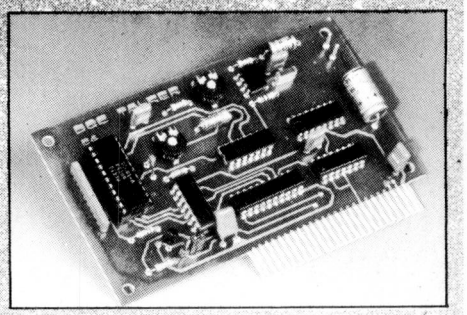
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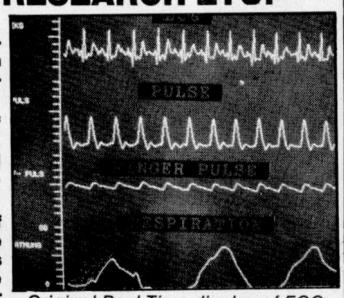
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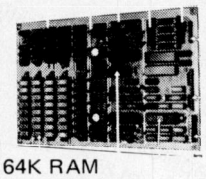
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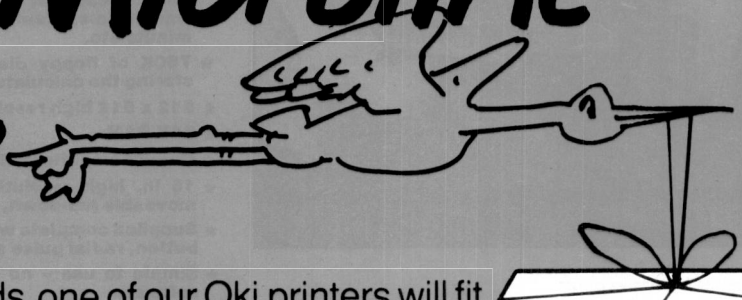
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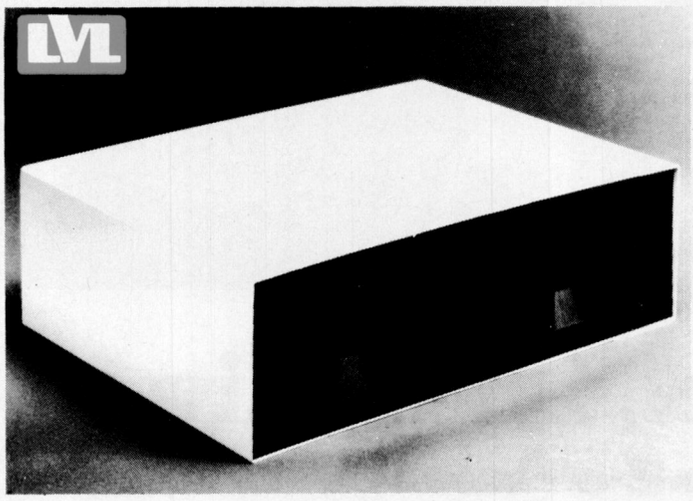
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COMPAS compiles a large subset of Standard Pascal directly into native Z-80 machine code, at a speed of up to 5000 lines per minute on a 4 MHz system! And a program written in COMPAS is 5 to 25 times faster than the same program in BASIC.

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**Overseas distributor:**
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COMPAS is highly interactive. On finding an error during compilation, the compiler automatically invokes the on-screen editor and moves the cursor to the point of error, ready for immediate editing and recompilation.

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* COMPAS is currently available in Gemini, Superbrain, RML 380Z, Apple II 16-sector (SoftCard), and IBM 3740 8" disk formats. More formats are being implemented.

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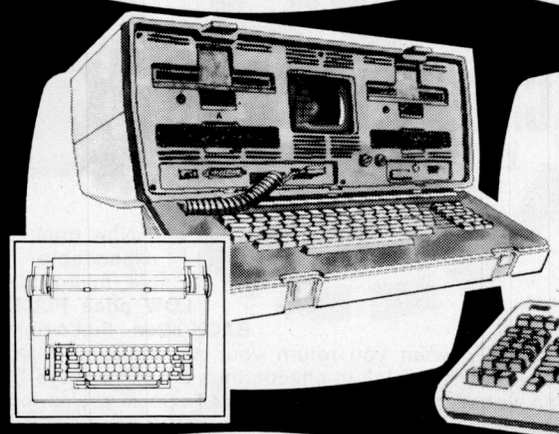
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# spectrum

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We believe that our product **'know-how'** is crucial to you the customer. That's why in every one of our centres you'll find **fully trained personnel**, who have been **trained by the importers or distributers themselves** – so we **know** and **understand** the products we sell and can help every customer even the complete beginner. At **SPECTRUM** we find the **RIGHT** equipment to suit your needs. Handing over sealed boxes is not our line – our service includes **'hands-on' experience** that we pass on to **YOU.**

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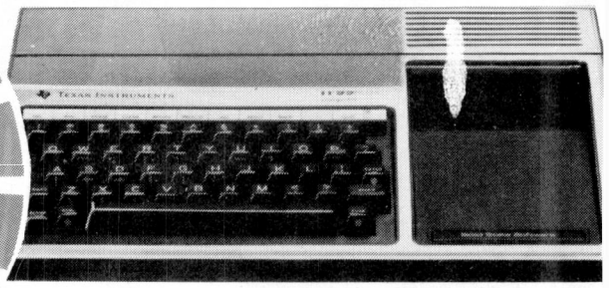
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Please ask for full details
Offer expires 31.1.83



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- 16K RAM (expandable to 48K)
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- Extensive range of solid state software command modules available from games to architectural aids.

**Spectrum LOW Price £173.00** PRICE INC. VAT £198-95

| | EX. VAT | INC VAT |
|---|---|---|
| **TEXAS PERIPHERALS** | | |
| Speech Synthesizer | £40.50 | £45 |
| Peripheral Exp. System | £122.00 | £140 |
| Disc Cont. Card | £124.30 | £142 |
| Disc Drive | £234.74 | £269 |
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| Matrix printer | £347.78 | £399 |
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| TI Invaders | £16.48 | £18 |
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The VIC-20 represents **superb value-for-money** from **SPECTRUM.** A truly **expandable** computer system which can be as simple or as complex as your needs require. Ideal as a home micro with a large number of **educational & games cartridges** available. Equally, with additional memory expansion, a disc drive and printer, it becomes suitable as a **small business system,** powerful enough for stock control, book-keeping and payroll generation.

- Memory expandable to 32K
- High resolution (full PET type) graphics
- 16 Screen colours & 8 border colours
- Plugs in to your T.V. or monitor
- Add Disk Drive & Printer for impressive 170K Byte system
- Can act as an intelligent terminal for a larger computer.

**Unbelievable New LOW price £127.50** Ex. VAT **(£146.63 inc. VAT)**

| VIC C2N | Exc. VAT | Inc. VAT |
|---|---|---|
| cassette unit | £34.00 | £39.10 |
| VIC Printer | £185.00 | £212.75 |
| VIC Single floppy disk drive (5¼") | £260.83 | £299.95 |
| 3K RAM | £24.00 | £27.60 |
| 8K RAM | £34.00 | £39.10 |
| 16K RAM exp. cartridge | £59.00 | £67.85 |
| Super exp. Hi Res cartridge | £27.50 | £31.63 |
| Joystick | £6.52 | £7.50 |
| Games paddles | £11.74 | £13.50 |
| Programmers Aid cart | £27.50 | £31.63 |
| Machine Code | £27.50 | £31.63 |
| Basic (1) | £13.00 | £14.95 |
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| **GAMES** | | |
| "Avenger" | £17.35 | £19.95 |
| "Start Batle" | £17.35 | £19.95 |
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| "Super Slot" | £17.35 | £19 |
| "Alien" | £17.35 | £19 |
| "Mole Attack" | £17.35 | £19 |
| "Adventure Land" | £21.70 | £2 |
| "Mission Impossible" | £21.70 | £2 |
| "Voodoo Castle" | £21.70 | £2 |
| "Blitz" (cass.) | £4.34 | £ |
| **BOOKS** | | |
| Learn Computer Programming w the Commodore VIC | £1.95 | No |
| VIC Revealed | £10.00 | No |
| VIC 20 Prog. Reference Guide | £14.95 | No |
| VIC Computing Magazine | £0.95 | No |

## Super RABBIT Software for VIC-2

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Not all stores carry every advertised item, please phone before making a journey — Prices correct at time of going to press E. & O.E.

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### Pocket Computer complete with Cassette/Printer interface




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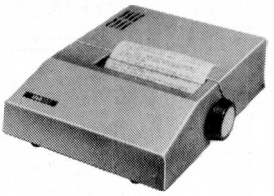
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| Dos. Utilities Listing | £3.47 | **£3.99** |

| Atari Home Computer Programs— | EX. VAT | INC. VAT |
|---|---|---|
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| Statistics 1 | £13.03 | **£14.99** |
| **Home Study** | | |
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| | EX. VAT | 'NC. VAT |
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**Spectrum LOW price £189.00** Price inc VAT £217.35

| Also Available | EX. VAT | INC. VAT |
|---|---|---|
| GP-100VC (for VIC-20) | £199.00 | **£228.85** |
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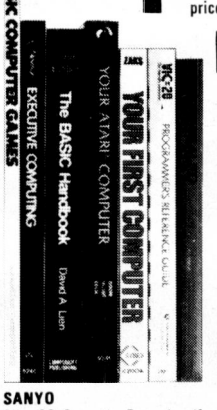
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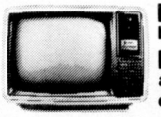
| | |
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| C12 Cassettes | £0.43 | **£0.50** |
| Single sided, double density disks(for Commodore, Atari, Apple, Tandy etc. | £1.70 | **£1.95** |
| Double sided, double density disks (for Sharp and Superbrain) | £2.87 | **£3.30** |
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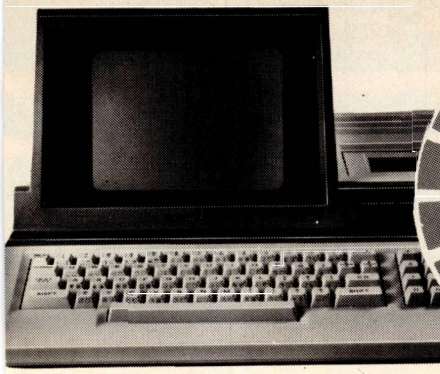


■ **18 MHz band width**
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|---|---|---|
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# Jupiter ACE




The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and te times as fast as BASIC. Before the Ace all personal compute used BASIC and FORTH was only available to a privileged fe

The Jupiter Ace also features a full-size moving-key keyboard, high-resolution graphics, sound, floating point arithmetic, a fast and reliable cassette interface and 3K of RAM.

**If you own a personal computer** you will be aware of the limitations of BASIC. You know how slowly your programs run an how quickly your computer's memory gets filled. The Jupiter Ace your answer.

**If you already know FORTH,** the Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to lis and alter words that have been previously compiled into the dictiona This avoids the need to store screens of source, allowing the diction itself to be saved on cassette. Comprehensive error checking remove the worry of accidentally crashing your programs.

## *All inclusive price*

**For £89.95** you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black a white), a software catalogue and a manual.
The manual is a complete introduction to the world of personal computin and a course in FORTH programming on the Ace.
Even if you are a complete newcomer to computers, the manual will guid you step by step from first principles to confident programming.
The price includes postage, packing and V.A.T.
The Jupiter Ace is backed by a full 12 month warranty.

"The Ace is an excellent way of using FORTH"

*Popular Computing Weekly*

## *Available soon*

**Plug-on parallel printer interface.**
For around £20.00 this will connect your Jupiter Ace to anything from high-speed matrix to letter-quality daisy wheel printers.

**Plug-on 16K Memory Expansion**
For around £30.00 you will increase the memory of your Jupiter Ace to 19K giving instant access to enormous amounts of information.

**Software**
A catalogue will be sent with every machine, and includes, initially, programs for education and entertainment.

"FORTH is an easy language"

*Byte*

## FORTH Finishes First!

Speed Comparison Chart showing times in seconds to perform one thousand operations.

| Type of Operation | Jupiter Ace | BBC Micro | Vic 20 | Spectrum | ZX81 |
|---|---|---|---|---|---|
| Empty loop | 0.12 | 0.67 | 1.3 | 4.2 | 17.7 |
| Print a number | 7.5 | 13.5 | 26 | 19 | 430 |
| Print a character | 0.62 | 1.3 | 3.1 | 7.5 | 24 |
| Add two numbers | 0.45 | 1.4 | 5.5 | 7.5 | 28 |
| Multiply two numbers | 0.9 | 1.6 | 6.5 | 7.5 | 32 |

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

# only £89.95

## )esigned by Jupiter Cantab

)mputer Designers Steven Vickers and Richard Altwasser ayed a major role in creating the ZX Spectrum and then rmed Jupiter Cantab to develop advanced ideas in personal )mputing. The Ace is the result, another all-British computer lead the world.

## 'echnical Information

**ırdware**
Z80A running at 3.25 MHz.
8K bytes ROM
3K bytes RAM

**ıyboard**
40 Moving-key keyboard with to repeat on every key and ips Lock.

**:reen**
Memory mapped 32 column x 4 line flicker-free display with )per and lower case ascii aracter set.

**raphics**
Chunky graphics (64 x 46 xels) may be plotted, unplotted over-plotted (XOR operation). so, the entire character set 28 characters and their video verses) may be redefined lowing intricate shapes to be awn with a resolution uivalent to 256 x 192 pixels.

**ontrol Structures**
**IF–ELSE–THEN, DO–LOOP O–+LOOP, BEGIN–WHILE–EPEAT, BEGIN–UNTIL,** all may e mixed and nested to any epth.

**Cassette**
Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

**Expansion Port**
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

**Data Structures**
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

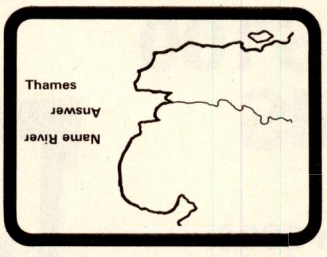
**Sound**
Internal loudspeaker may be programmed to operate over the entire audio spectrum.

## Programming in FORTH

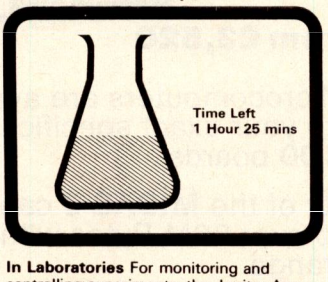
**rogramming in FORTH**
FORTH programs are constructed without line-umbers, as words which are defined in terms of other ords that already exist. Consider the following efinition of the word **STARS**. Comments are in arenthesis and have no action.

```
STARS          (: starts word definition)
  ." *** "     (print 3 asterisks)
  200 100 BEEP (play a note for
                100 mSecs)
;
```

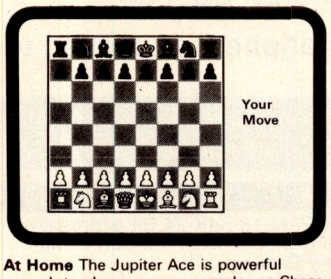
The semi colon at the end finishes the ord definition. Now, whenever you say TARS the computer will print out 3 sterisks and sound a short tone. (Notice ow the word **BEEP** comes after the umbers it uses, 200 and 100. This haracteristic occurs throughout FORTH so nat you write, for instance, 28 76 + instead f 28 + 76.)
The Jupiter Ace already has 140 FORTH ords defined in ROM.



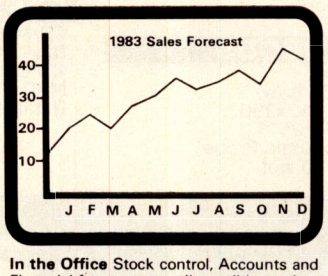

**In Schools** Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.




**In Laboratories** For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.




**At Home** The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.

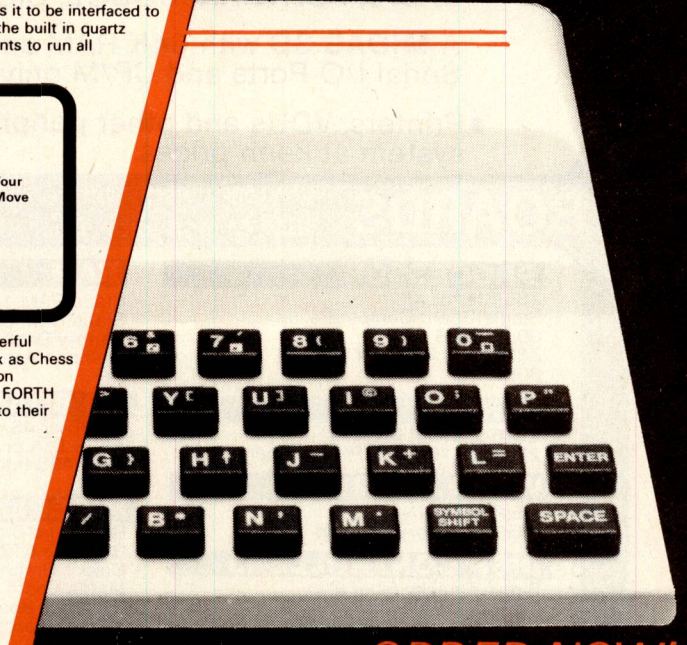



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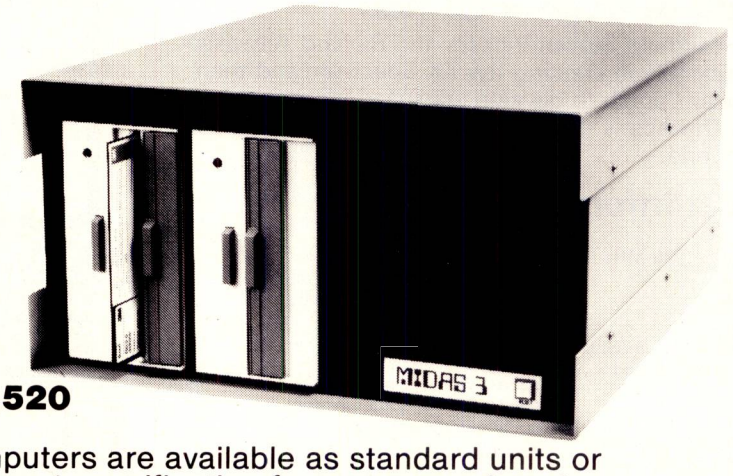
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# ANYTHING IBM CAN DO...




It's 16 BIT. It's IBM PC compatible. And it's here now!

Icarus have a new personal computer manufactured by Columbia Data Systems of the USA complete with its own software and hardware. It will also run all software and hardware produced for the IBM PC.

At first glance, this machine may bear a certain resemblance to its mentor.

That's before you switch it on.

## What a performance!

Appearances can be deceptive as a look at the credentials of the Columbia PC machine will tell you.

Operating system software is MS-DOS® or CP/M 86®.

Its 16 BIT 8088 hardware configuration provides 128 K RAM with parity, two RS-232 serial ports, Centronics parallel printer port, DMA controller, eight levels of interrupt, dual floppy disc system with one megabyte storage, Winchester interface and eight expansion slots.

Not bad for the standard version.

**16 BIT IBM PC COMPATIBLE**

## Examine your options

Columbia like to leave your options wide open. So they've included 256K RAM boards, 8087 arithmetic co-processor for high speed math functions, dual RS-232/RS-422 boards, and a Winchester disc based system.

The Columbia PC's expansion capability can easily accommodate just about any imaginable hardware configuration including one megabyte RAM and 10 megabyte disc.

## It's here now

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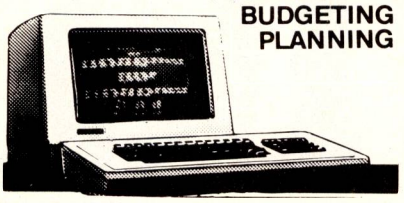
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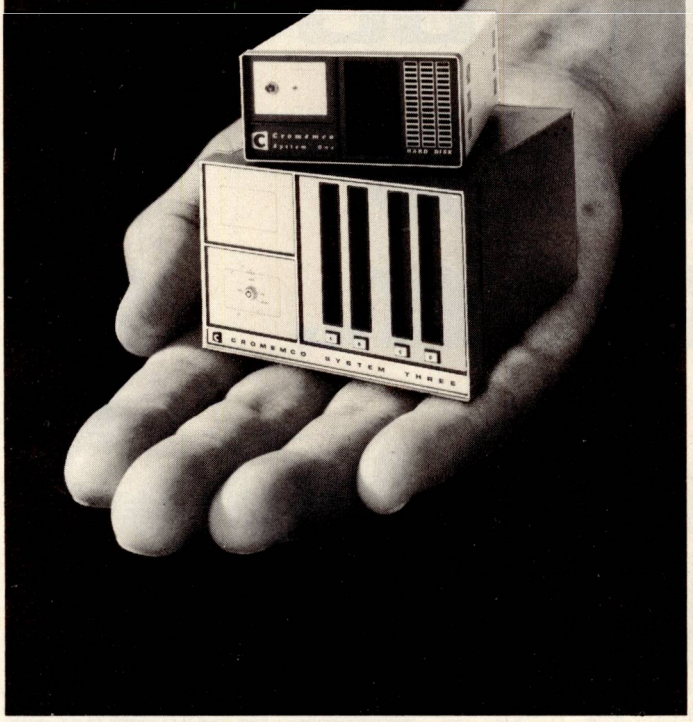
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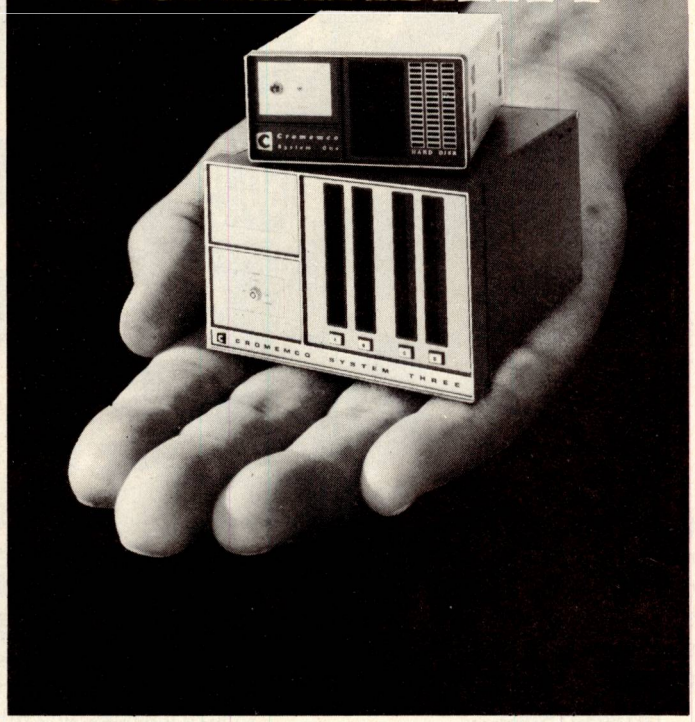
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And that is the only concession that the new Cromemco 16 Bit System needs to make.

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But it takes Cromemco to put promise on the path to reality. So to support MC68000 processing power there is a new concept in memory cards, full S100 **and** IEEE 696 compatibility, and a new software library based on 16 Bit Code to optimise the new found processing power.

The Memory Storage comes in single 256K or 512K cards with built in error detection and correction. That gives a full 4MByte of high speed memory in a Cromemco 16Bit System 3, with internal space to spare. The S100 and IEEE 696 compatibility offers the widest possible options in add-on facilities and interface requirements.

The new software library is comprehensive. There is a 16 Bit version of the proven Cromix Multiuser operating system, (now it will support up to 18 users or tasks). There is a new Fortran 77, designed for creating larger programs in a science/engineering/research environment, and COBOL, PASCAL and 'C', a Structured BASIC, and a 68000 Assembler.

Overall the Cromemco 16 Bit Systems extend the existing boundaries of microcomputer application. In particular, they offer the Scientist and Engineer the opportunity to dramatically reduce the cost of performing the complex mathematical functions required in multi dimensional design, simulation and analytic processes. What was once mainframe capability and became mini is now decidedly Cromemco Microcomputer capability.

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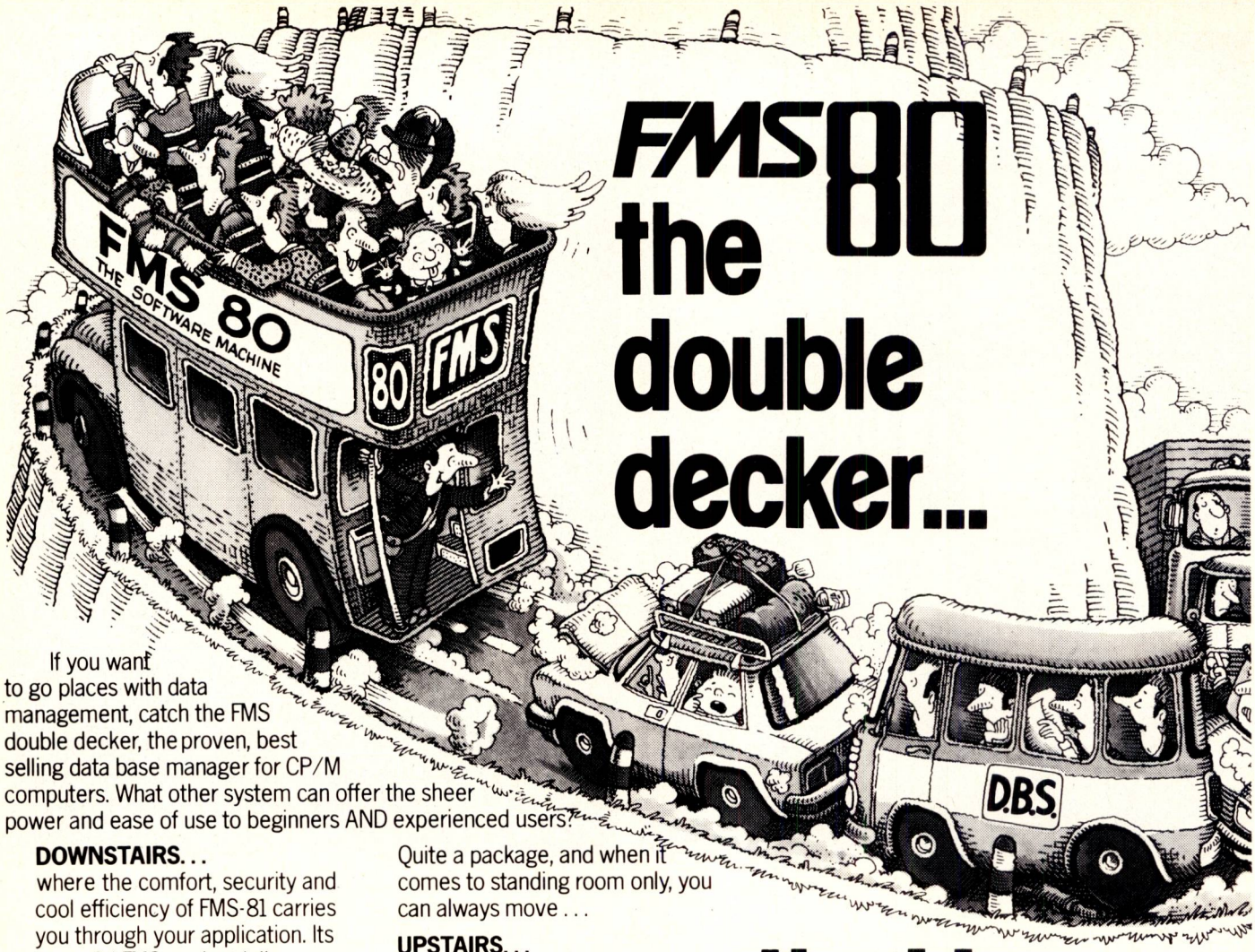
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We do not sell washing machines, cameras, videos or records. Unlike many of our recent competitors, we have been in the computer business for many years and have fully experienced staff, able to give you the advice you need whether you just have an interest in personal computers or whether you wish to buy a relatively sophisticated system for your business needs.

We are all independent enterprises who have grouped together to form MicroValue. This gives us the benefit of increased buying power, which we can in turn pass on to you, our customer. We can also pool our extensive experience in a wide range of computer-related activities, allowing us to give you the best advice.

We are not in business just to sell you the machines and a 13 amp plug. We are prepared to work with you after your purchase to make sure that you obtain the maximum benefit from the marvellous opportunities being offered as micro computers come within the grasp of many small businesses. At the other end of the scale, we are all computer enthusiasts and are delighted to introduce newcomers to the variety of machines under £200 that make an inexpensive, but fascinating, introduction to the world of computers.

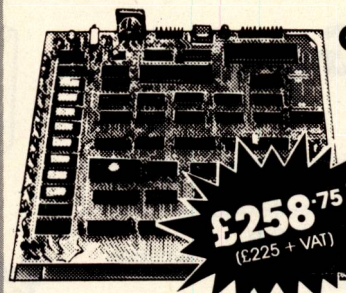
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## MULTIBOARD



### GM813 — CPU/64K RAM Board

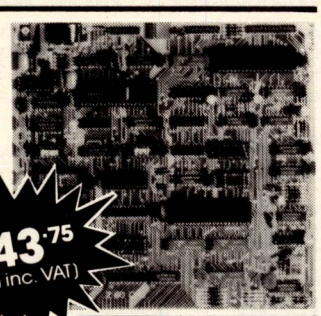
£258.75 (£225 + VAT)

- ★ 4 MHz Z80A CPU
- ★ 64K Dynamic RAM
- ★ RS232 Serial Interface
- ★ Two 8-Bit I/O Ports
- ★ 1200 Baud Cassette Interface
- ★ Extended and Page Addressing Modes

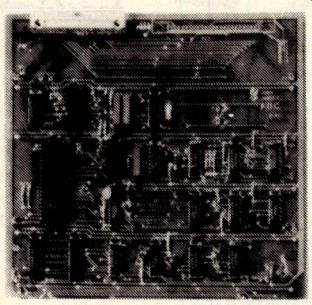
The Gemini GM813 is a new 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

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- ★ 4MHz Z80A CPU
- ★ Four 'Bytewide' Memory Sockets
- ★ Two 8-Bit Input/Output Ports
- ★ 8 Bit Input Port
- ★ RS232 Serial Interface
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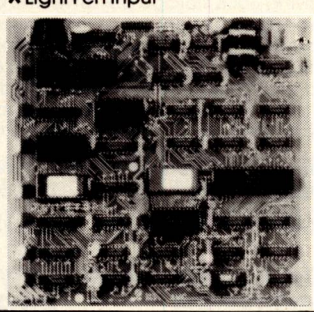


£143.75 (each inc. VAT)



### GM812 — IVC Board

- ★ 80x25 Display Format
- ★ On-board Z80A Microprocessor
- ★ Buffered Keyboard Input
- ★ Programmable Character Generator
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- ★ Light Pen Input



### GM809 — FDC Board

- ★ Disk Controller Board
- ★ Single/double density
- ★ Single/double sided
- ★ 8" or 5.25" Drives

### Other boards available in the Multiboard range:

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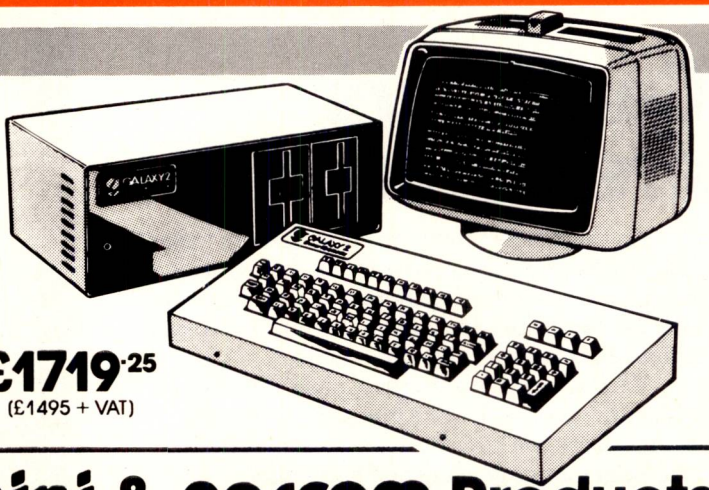
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## COMPUTERS

## New from Gemini

### Gemini Galaxy 2

- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
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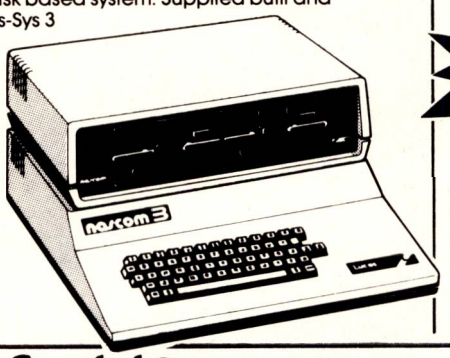


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## Total support for Gemini & nascom Products

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**48K System**
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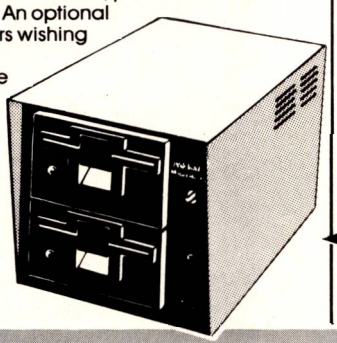
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**GM809 — full Nas-Bus floppy disk controller card — drives up to 4 drives — optional 8" expansion — £143.75 inc. VAT. GM815 — Double density disk system.**
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**Single drive system (G809, G815/1)**
**£517.50** (£450 + VAT)

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**£776.25** (£675 + VAT)

**CP/M 2.2 package (G513)**
**£115.00** (£100 + VAT)

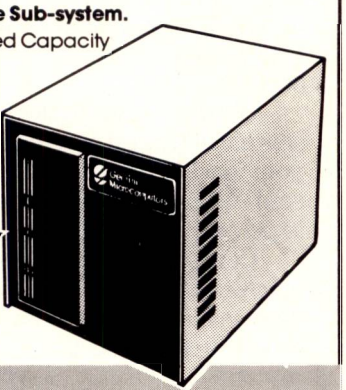
**POLYDOS 2**
**£103.50** (£90 + VAT)

### At last — a Winchester Drive for your Gemini / nascom System!

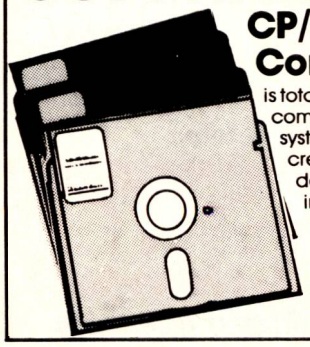
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## SOFTWARE



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**£138.00** (inc. VAT)

**'The Last One'** is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.

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***MBASIC** — MicroValue Price — **£178.95 inc. VAT**

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| **GEM ZAP** Assembler | **£51.75 inc. VAT** |
| **GEM DEBUG** Debugging Utility | **£34.50 inc. VAT** |
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A wide range of software for Nascom also available.

When ordering disks, please specify format.

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★ 6809E Microprocessor
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★ Advanced Graphics
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**FREE** cassette with every Dragon purchased.



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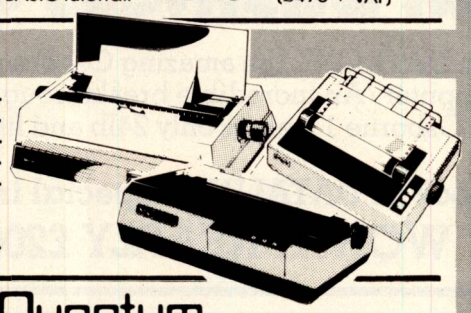
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### Quantum HI-COPY FOR MZ80K

This combination of hardware and software not only allows printing of the full Sharp character set, but allows a full High Resolution print of the actual screen if used with the Hi-Res graphics option.

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Price includes printer

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Interface and ROMS and screen dump BASIC suitable for use with any EPSON PRINTER
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Price excluding printer

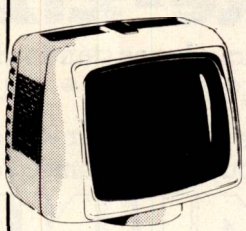
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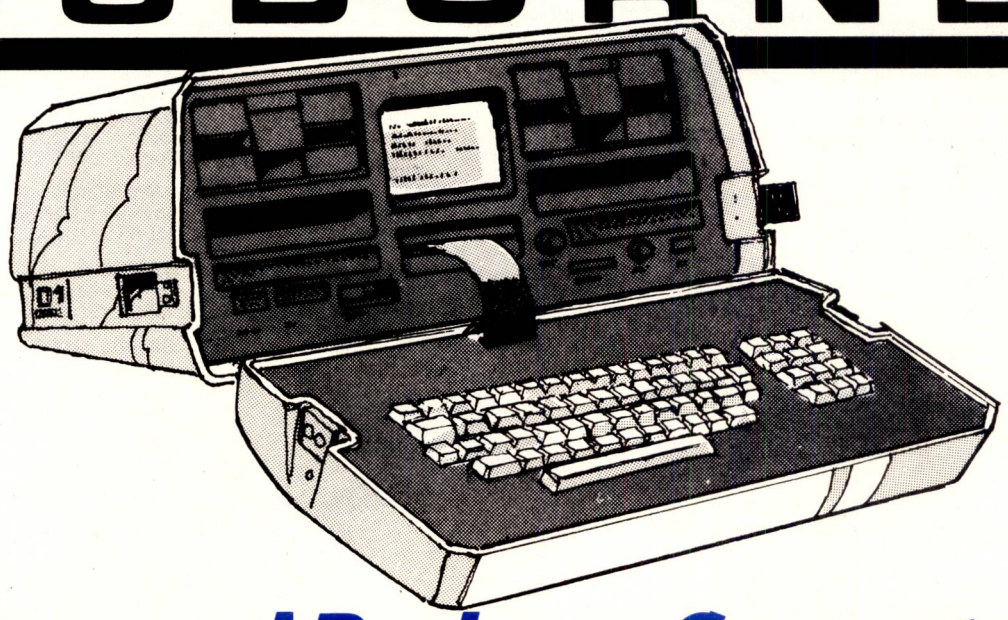
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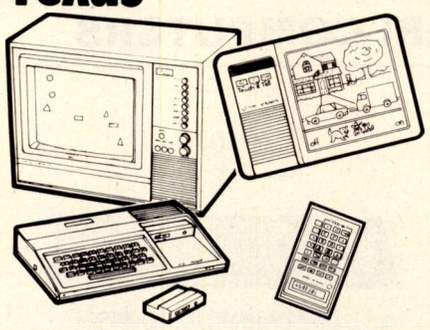
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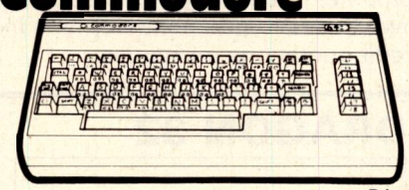
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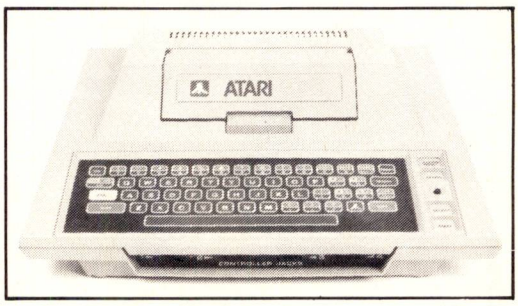
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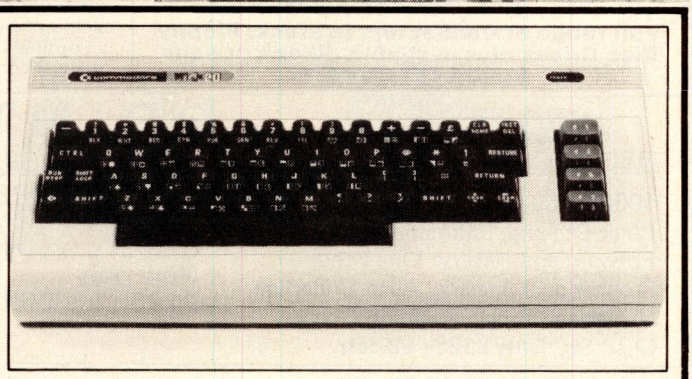
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| Macro Assembler | -1D-32K-BQ73Q | £59.95 |
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| Basic A+ & Operating System A+ | -1D-48K-BQ32K | £99.50 |
| Microsoft Basic | -1D-32K-BQ74R | £59.95 |
| Pilot (Educator) | -1E & 2C-16K-BQ75S | £79.95 |
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| QS Forth | -1D-24K-YL29G | £49.95 |
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| 6502 Disassembler | -1D-8K-YL31J | £12.95 |
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| Operating System User's Manual & Hardware Manual | -WA46A | £16.95 |
| Atari Basic-Learning By Using | -WG55K | £5.24 |
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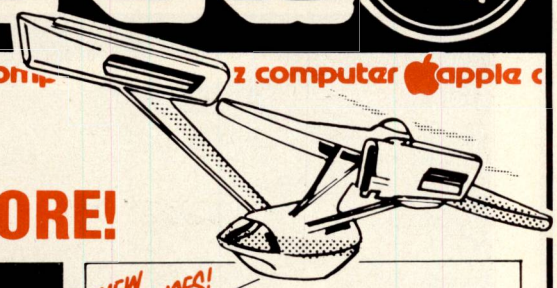
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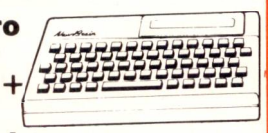
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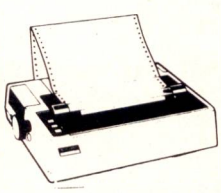


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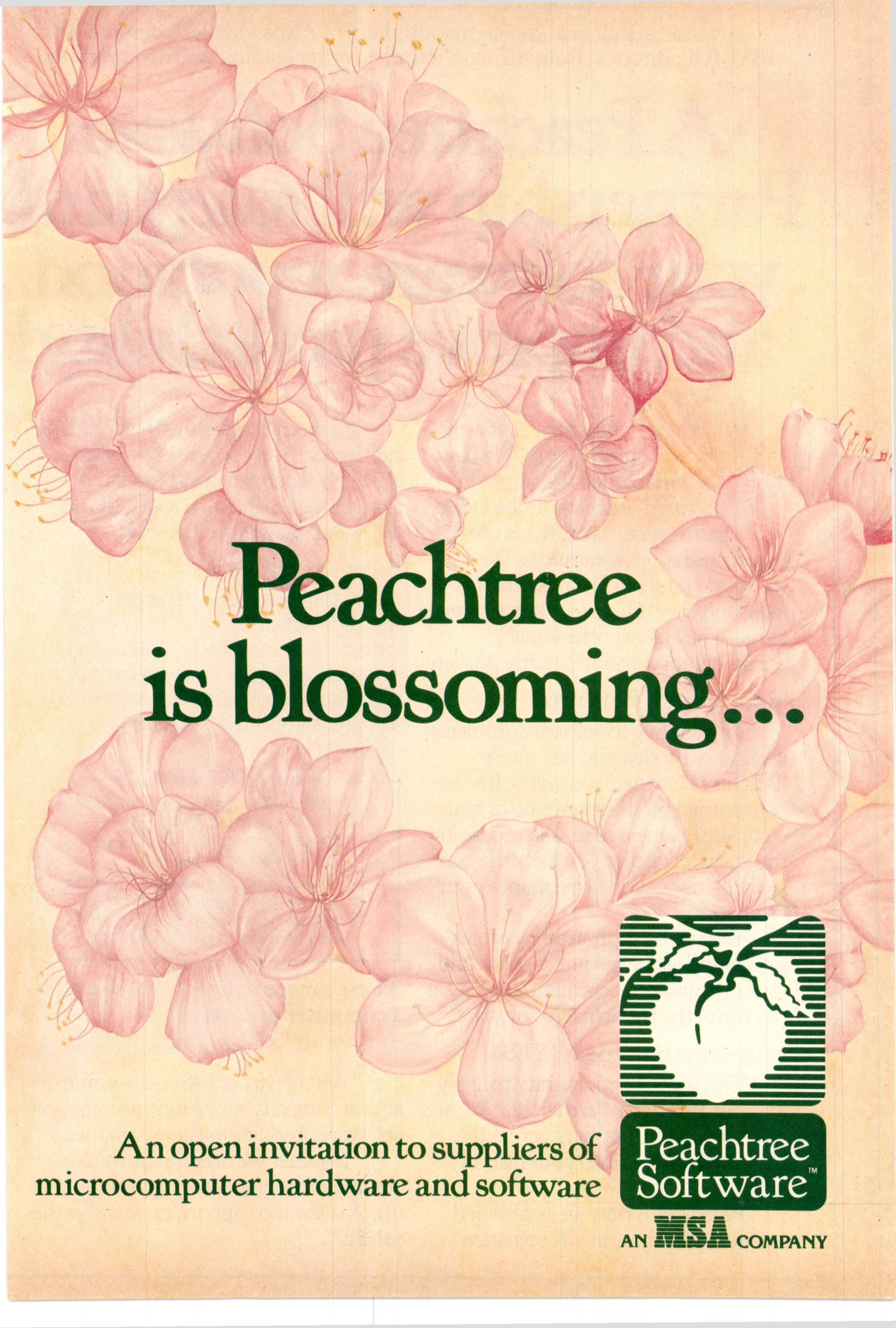


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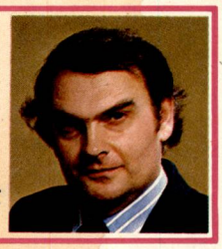
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# Read this ad

You: "Darling, I've decided to buy a computer."

Her: "**++**??!!***@XX??££**??!!? off!"

You: "Yes, I know we could do with a new washing machine. But the new Dragon 32 Computer is much more important. It's the first computer actually designed for all the family - and it costs under £200!"

Her: "**++??!!@££??! fortune!"

You: "No, I'm not being selfish. Computers are for the whole family - and they're going to play a big part in the children's future."

Her: "Oh?"

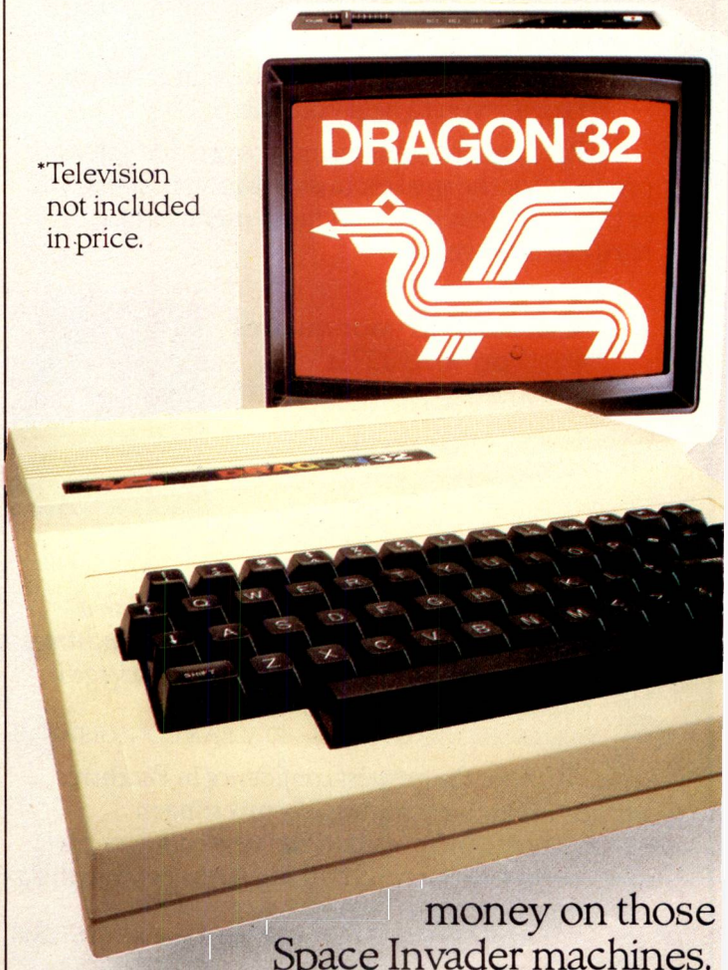
From this point on, the conversation should follow more reasonable lines. Allowing you to fully explain the many advantages of the new Dragon 32 family computer.

## 32K RAM FOR UNDER £200.*

For a start, the Dragon offers 32K RAM. Your wife may not understand that, so just tell her that the Dragon's capabilities are truly massive - at least twice as powerful as its competitors, with some features you won't find even in more expensive units. The Dragon will give you all the power you're likely to need, and more, to create your own programs - along with an exciting range of software which can do anything from helping with kids' spelling and arithmetic to creating your own cartoons.

## THE FIRST FAMILY COMPUTER.

All of which brings you nicely to the point where you tell your wife just how much fun the kids will have with the Dragon. How it will save her all that money on those Space Invader machines. How it will magically translate simple typed instructions into beautiful drawings and designs using set, line, circle, draw, scale, rotate and paint features, in up to 9 colours - and play and compose




*Television not included in price.

# to your wife.

| SPECIFICATIONS |
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| 6809E MICROPROCESSOR. Pet, Apple, Atari 400, BBC Micro, and VIC 20 still have the less powerful 6502. |
| 32K RAM (as standard). At least twice the power of similarly priced machines. Expandable to 64K RAM. |
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| 9 COLOUR, 5 RESOLUTION DISPLAY. |
| USE WITH ANY U.H.F. TV and/or separate P.A.L. monitor. |
| PROFESSIONAL QUALITY KEYBOARD. Typewriter feel. Guaranteed for 20 million depressions. |
| PRINTER (Centronics parallel). |
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with 5 octaves of music. How it will engross your children in mind-boggling adventures in dungeons and caves without even getting their knees dirty. And the Dragon works with any U.H.F. TV.

## THEY'LL LEARN AS THEY PLAY.

And then you can casually point out that although the kids are having fun, they're also learning. And within a very short space of time, the whole family will be completely at home with programming - with computer language - with every aspect of how computers work. Which can't do their future prospects any harm at all.

## BRILLIANTLY SIMPLE INSTRUCTION MANUAL.

The Dragon is made in Britain, designed with the help of British Universities. And it's also worth remembering that the Dragon's instruction manual is clearer and easier to understand than any other home computers.

That its top-quality keyboard is as easy to use as a typewriter, and so well made it's guaranteed for twenty million depressions.

## TAKE THE FAMILY DOWN THE HIGH STREET.

And if she still wants to know more, take her to see the Dragon 32. It'll soon be available in most good stores - or you can send the coupon for further details.

And if you're one of our many lady readers, please accept our apologies.

Perhaps you'd like to read this ad to your husband.

# DRAGON 32

## The first family computer.

To: Jean Webster, Dragon Data Ltd., Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH.
Tel: 0792 580651.

Please send me further information about the Dragon 32.

Name _____

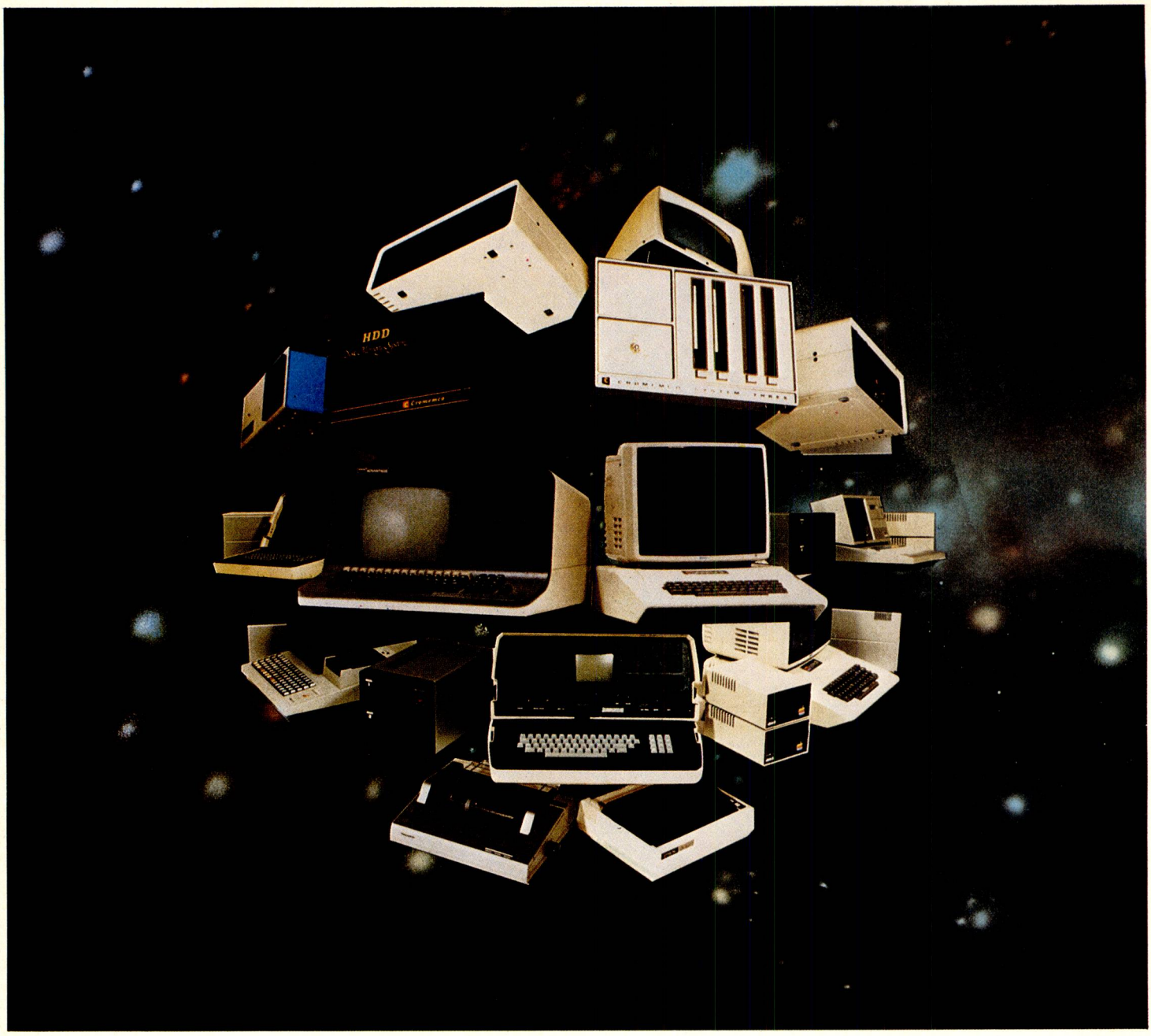
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2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 ( POINT
9 ) CAT
0 _ FORMAT
SIN Q ⇐ PLOT ASN
COS W <> DRAW ACS
TAN E >= REM ATN
INT R < RUN VERIFY
RND T > RAND MERGE
STR$ Y AND RETURN [
CHR$ U OR IF ]
CODE I AT INPUT IN
PEEK O ; POKE OUT
TAB P " PRINT ©
READ A STOP NEW ~
RESTORE S NOT SAVE |
DATA D STEP DIM \
SGN F TO FOR {
ABS G THEN GOTO }
SQR H ↑ GOSUB CIRCLE
VAL J − LOAD VAL$
LEN K + LIST SCREEN$
USR L = LET ATTR
ENTER
CAPS SHIFT
LN Z : COPY BEEP
EXP X £ CLEAR INK
LPRINT C ? CONT PAPER
LLIST V / CLS FLASH
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IN KEY$ N , NEXT OVER
PI M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

# Sinclair ZX Spectr

## *16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...*

## *From only £125!*




First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

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The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

### Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

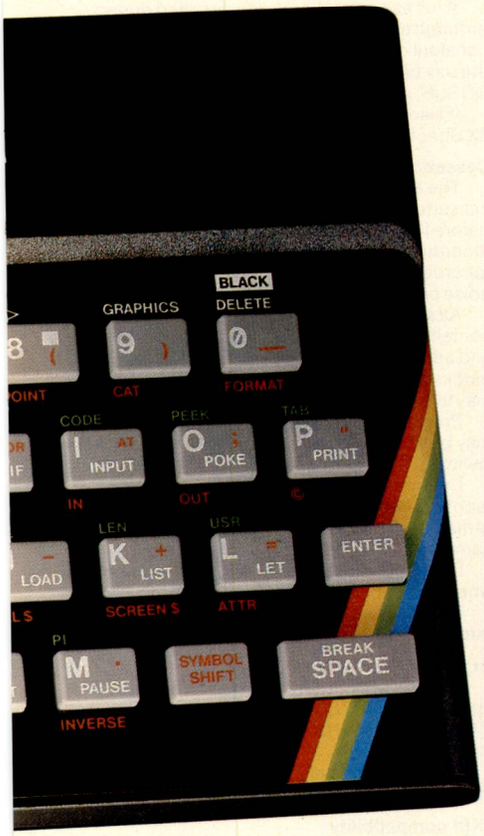
There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



### Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 10 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

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## X Spectrum software on assettes – available now

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## S232 / network terface board

This interface, available later this ar, will enable you to connect your Spectrum to a whole host of printers, minals and other computers.

The potential is enormous. And the onishingly low price of only £20 is sible only because the operating tems are already designed into the M.

sinclair

**clair Research Ltd, Stanhope Road, mberley, Surrey GU15 3PS.**
**: Camberley (0276) 685311.**

## The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

## The ZX Microdrive – coming soon

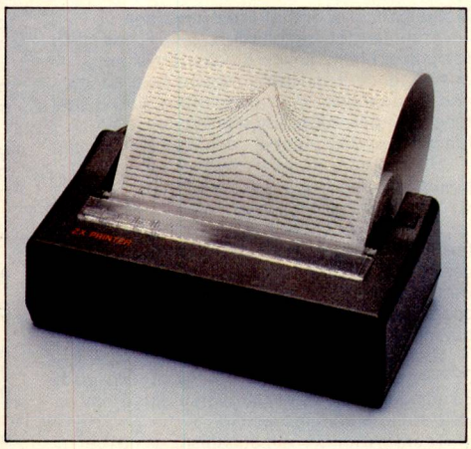
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

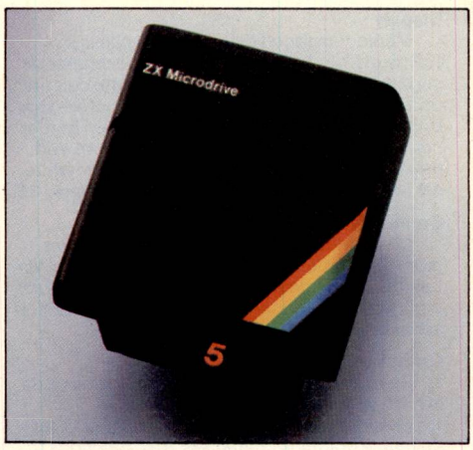
Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.






## How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

**To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.** **Order**

| Qty | Item | Code | Item Price £ | Total £ |
|---|---|---|---|---|
| | Sinclair ZX Spectrum – 16K RAM version | 100 | 125.00 | |
| | Sinclair ZX Spectrum – 48K RAM version | 101 | 175.00 | |
| | Sinclair ZX Printer | 27 | 59.95 | |
| | Printer paper (pack of 5 rolls) | 16 | 11.95 | |
| | Postage and packing: orders under £100 | 28 | 2.95 | |
| | orders over £100 | 29 | 4.95 | |
| | | | Total £ | |

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

PCW812

**FREEPOST – no stamp needed.** **Prices apply to UK only.** **Export prices on application.**

# Sinclair ZX Spectrum–technical data.

**Dimensions**

| | |
|---|---|
| Width | 233 mm |
| Depth | 144 mm |
| Height | 30 mm |

**CPU / memory**

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

**Keyboard**

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

**Display**

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

**Sound**

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/speaker.

**Graphics**

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

**Colours**

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive-or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

**Screen**

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

**Mathematical operations and functions**

Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3 \times 10^{-39}$ to $+7 \times 10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

**String operations and functions**

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

**Variable names**

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

**Arrays**

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

**Expression evaluator**

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

**Cassette interface**

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

**Expansion port**

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

**ZX81 compatibility**

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY. ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair

# ZX Spectrum

**Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.**

**Imagine a totally portable computer that slips into your briefcase, incorporating an LCD screen, full typewriter keyboard, printer and microcassette, and runs on its own power supply for use anywhere.**

**We did.**




# HX-20
## PORTABLE COMPUTER

EPSON
Extraordinary product.
Exceptional quality.

# The HX-20. The most complete portable computer available today.

## Taking the computer a step further.

A computer small enough to fit into a briefcase yet with full size typewriter keyboard, LCD Virtual Screen, printer and microcassette facility actually built in.

Improbable. Until today.

## Functions fantastic.



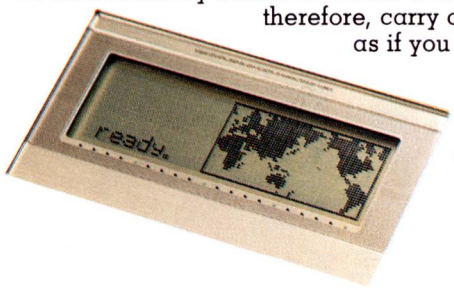

The HX-20 is a real computer, not a gimmicky toy. Or an extension of your calculator. Or just another desk top computer. It is a precision machine with 16k RAM which is optionally expandable to 32k and 32k ROM expandable to 64k, RS-232C and serial interfaces.

The full size ASCII typewriter keyboard and five programmable keys brings ten separate program functions to your fingertips.

The HX-20 can run on its own power supply for over 50 hours which can be easily recharged overnight, and has the ability to retain its memory in RAM even when switched off.

## Virtual Screen keeps you in the picture.

The HX-20's LCD Screen is unique, keeping you in the picture by showing any 20 characters by 4 lines at a time. You can, therefore, carry out word processing or data entry as if you are using a large screen.

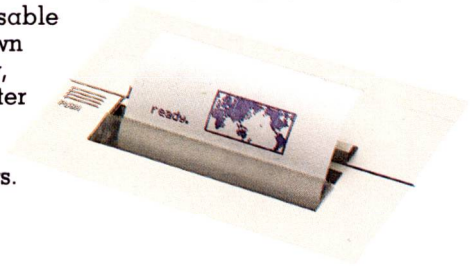



Upper and lower case letters, numerals, punctuation marks and graphics are easily read by simply adjusting the viewing angle.

## Print out. Built in.

A built-in 24 column dot matrix impact microprinter offers 42 LPM in a crisp, precise 5 x 7 matrix for perfect hard copies on plain paper. Every time.

And there's more. . .Bit addressable graphics allow you to design your own characters for full graphic capability, a cartridge ribbon, full ASCII character set including £ sign and enough international symbols for reproducing most Western languages.




## Add-on capability.

Choose from a wide range of peripherals. Barcode readers, audio cassette for loading and saving programs, microcassette and ROM cartridges, and the world famous Epson dot matrix computer printers for quality output . . .to name just a few.



Via acoustic couplers this superb machine can also be linked through the telephone to other computers.



## Software and the hard facts.

The HX-20 uses a full extended version of Microsoft BASIC, with a 24 hour clock, date and alarm, string functions, and music generation. The interface options (with RS-232C and serial interfaces as standard) include a standard cassette, a ROM cartridge, plus a system bus that allows you to expand the RAM and ROM capabilities.



## Portability for Programability. Anywhere.

The HX-20 is light and totally portable for writing programs and manipulating data – virtually anywhere. (Just four nickel-cadmium batteries and a low power all-CMOS memory gives you a reliable power source during your travels.)

Back at the office you can dump your data or programs onto a cassette or into your main computer system.

## Reliability through Research.

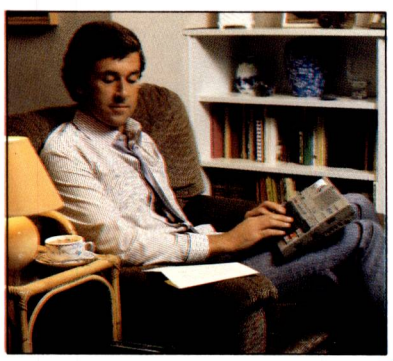
A computer coming from Epson has got to be good. After all we have been responsible for high quality precision manufacture since 1961. Just take a look at our impressive track record with the hugely successful Epson dot matrix printers.

So it follows that you can expect the same quality, the same reliability through our extensive research program prior to launching









any revolutionary new product. Now that product has arrived. The HX-20 is here today. From Epson.
But it's got to be seen to be believed.

Clip the coupon below and return it to us – Freepost – no stamp required and we'll send you the complete list of HX-20 stockists by return.

If you would also like further details of how the HX-20 can be suited to your particular requirements simply include your area of business and any other relevant details separately or on the back of the freepost coupon.




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# Specifications of HX-20

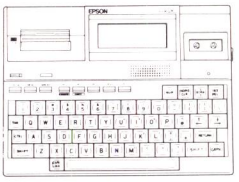
## Dimensions and Ambient Conditions

Dimensions and Weight

| | |
|---|---|
| **1.** Dimensions: | 290mm wide<br>215.5mm deep<br>44mm high |
| **2.** Weight: | Approx. 1.7 kg |







Ambient Conditions

| | |
|---|---|
| **1.** Temperature: | 5°C to 35°C (operating)<br>5°C to 35°C (charging)<br>–5°C to 40°C (data storage) (RAM battery backup)<br>–20°C to 60°C (non-operating) |
| **2.** Relative humidity: | 10% to 80% (operating, no condensation)<br>10% to 80% (non-operating, no condensation) |
| **3.** Shock resistance: | 1 G for 1 ms maximum (operating) |
| **4.** Vibration resistance: | 0.25G 55 Hz maximum (operating) |

## Power Supply (Nicd batteries)

| | |
|---|---|
| **1.** Voltage: | 4.5V to 6.0V (operating)<br>4.0V to 6.0V (data storage)<br>4.5V (low voltage detection) |
| **2.** Battery capacity: | Approx. 1100 mAH |

## AC Adaptor

| | |
|---|---|
| **1.** Input voltage: | AC 220V/240V ± 10% |
| **2.** Power consumption: | 8W |
| **3.** Insulation resistance: | 10megohms between AC power supply and case |
| **4.** Insulation strength: | Can withstand 1 kV applied between AC power supply and case for 1 minute or more |

## Microprinter (M-160)

| | |
|---|---|
| **1.** Printing system: | Dot impact (4 printing solenoids) |
| **2.** Printing format | |
| a. Total number of dots: | 144 dots maximum/dot line |
| b. Number of characters per line: | 24 maximum<br>(5 x 7 dots; character-to-character space 1 dot)<br>(6 characters/printing solenoid) |
| **3.** Printing speed | |
| a. 1 dot line: | Approx. 150 ms (continuous printing) |
| b. 5 x 7 dot matrix (interline space 3 dots): | Approx. 0.7 line/s (continuous printing)<br>42 lines per minute |
| **4.** Character size | |
| a. Dot spacing: | 0.33mm horizontal<br>0.33mm vertical |
| b. 5 x 7 dot matrix: | 1.7mm wide, 2.4mm high |
| **5.** Recording paper | |
| a. Kind: | Plain paper |
| b. Paper width: | 57.5 ± 0.5mm |
| c. Outside diameter: | 50mm or less |
| d. Thickness: | 0.07mm |
| e. Weight: | 52.3 g/m$^2$ (45 kg/1000 sheets/1091 sheets x 788mm) |
| **6.** Paper feed: | Automatic feed every dot line; with paper release |
| **7.** Inking | |
| Ribbon cartridge type | |
| Automatic continuous feed during motor operation | |
| a. Colour: | Purple/Black |
| b. Dimensions: | Approx. 91mm wide, 25mm deep, 7mm high |
| c. Life: | Approx. 10,000 lines |
| d. Standard: | ERC-09 |

## Liquid Crystal Display

| | |
|---|---|
| **1.** Text: | Upper and lower case, numerals, symbols, graphic characters and more; 20 characters per line; 4 lines in total (20 x 4 = 80 characters) |
| **2.** Graphic: | 120 dots (horizontal) x 32 dots (vertical) = 3840 dots |
| **3.** View angle adjustment: | Adjustable with VIEW ANGLE density control |

## Keyboard

| | |
|---|---|
| **1.** Key switches: | Typewriter layout, full size. 68 keys (including 5 function keys and 13 special keys) |
| **2.** Others: | Power on switch, VIEW ANGLE density control for LCD, and adjusting circuit built in |

## RS-232C Interface

| | |
|---|---|
| **1.** Connector: | DIN (8-pin) TCS 4480 |
| **2.** Input and output levels: | RS-232C standard |
| **3.** Transfer speed: | 110, 150, 300, 600, 1200, 2400, 4800 bps (selectable by operator) |

## Serial Interface

| | |
|---|---|
| **1.** Connector: | DIN (5-pin) TCS 4450 |
| **2.** Input and output levels: | RS-232C standard |
| **3.** Transfer speed: | 38, 150, 400, 600, 4800 bps (selectable by operator). |

**HX-20**
**PORTABLE COMPUTER**

EPSON

Epson (UK) Limited
Dorland House
388 High Road Wembley
Middlesex HA9 6UH
Telephone: 01-900 0466/9
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The entire PC-8000 system is now available through better computer dealers across the country. And that means more than hardware. It means effective software, the finest documentation and extensive training to help you get the most from your personal computer. So why not turn our system to your personal advantage now.

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Tokyo, Japan

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Personal Computer World




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## The cost effective solution to your computer needs for only £1,450*

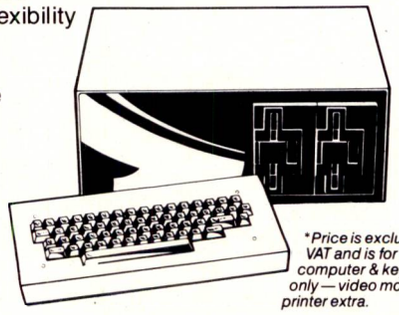
**The Galaxy 1 desk top computer system can be used in education, small business applications, word processing, stock control and a host of other environments. Our choice of CP/M as the operating system means that our customers can select a suitable application package from the widest possible range.**

However, unlike our competitors, we supply not only the hardware but all the essential system software needed to start using the Galaxy 1 as soon as it is installed. We have adopted COMAL-80 as our standard language. This structured basic is rapidly gaining widespread acceptance and popularity especially in the education market, offering much greater flexibility and ease of use than existing Basics. We also supply a very powerful Z80 assembler/editor called GEM ZAP with GEM PEN, a compact but very powerful word processing package. The system software suite is completed with GEM DEBUG, a useful machine code program de-bugging utility.

Modular design means reliability and ease of maintenance. Unlike many other manufacturers Gemini offer a full one year warranty (except Disc heads which are guaranteed for 3 months). Our distributors carry a full range of replacement boards thereby facilitating a quick, efficient and cost effective back up customer service.

*Features include:*

- **Twin Z80 Processors**
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- **800 K Disc Based Storage**
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- **Dual Printer Interfaces**
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- **CP/M 2.2 Operating system**
- **COMAL-80 – Structured Basic**
- **Z80 Editor/Assembler**
- **Text Editor & Formatter**
- **Program De-Bugging Utility**



*Price is exclusive of VAT and is for computer & keyboard only — video monitor & printer extra.

***BRITISH MADE***

**Telephone Amersham 28321 for the name and address of your nearest distributor.**
**** Dealer enquiries invided.***

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ROOM PCW, 8 CAMBRIDGE HOUSE, CAMBRIDGE ROAD, BARKING, ESSEX IG11 8NT, ENGLAND
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## SOFTWARE FOR CP/M COMPUTERS

### NTHONY ASHPITEL /PING TUTORS

| | Software & Manual | Manual Only |
|---|---|---|
| SIC VERSION | £50 | |
| SINESS VERSION | £125 | £25 |

### /ROM SOFTWARE

| | | |
|---|---|---|
| AM—Utility to link one micro-puter to another also using BSTAM | £112 | £7 |
| MS—Utility to link a micro to a mi nainframe | £112 | £13 |

### P/M USER LIBRARY

| | | |
|---|---|---|
| Volumes—Price per volume | | |
| disc (one volume per disc) | £5 | |
| disc (one volume per 2 discs) | £10 | |
| ex | | £2 |

### GITAL RESEARCH

| | | |
|---|---|---|
| ASIC v 2.08 | £76 | £16 |
| 80 1.3 | £312 | £21 |
| SCAL MT+ | £206 | £24 |
| SCAL MT+ WITH SPP | £297 | 35 |
| SCAL MT+ LIB SOURCES | £129 | |
| SCAL MT+ SPP ONLY | £147 | £12 |
| M 1.1 | £138 | £21 |
| M 2.0 | £288 | £35 |
| M86 | £171 | £32 |
| M 2.2 | £103 | £24 |
| NET | £126 | £16 |
| 86 | £94 | £8 |
| 1.4 | £50 | £16 |
| D 1.4 | £65 | £16 |
| C | £62 | £16 |
| 3.0 | £65 | £16 |
| SPOOL | £31 | £7 |
| I-80 | £315 | £32 |
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### ECTRONIC ACCOUNTING RVICES

| | | |
|---|---|---|
| EAR & GOAL PROGRAMMING | £200 | £10 |

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| | | |
|---|---|---|
| CKSCREEN FOR DBASE-II | £103 | £14 |
| CKSCREEN FOR CBASIC/CB-80 | £103 | £14 |
| CKSCREEN FOR MBASIC | £103 | £14 |
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| | | |
|---|---|---|
| REV | £65 | £13 |
| LENE | £40 | £6 |
| ORG | £50 | £6 |
| ED-2 | £65 | £8 |
| TOOLS-1 (DISKREV-DISKORG) | £90 | £15 |
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| | | |
|---|---|---|
| ECTOR-V 1.6 | £324 | £29 |

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| FORTH | £85 | £23 |
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| | | |
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| FORMS 2 | £110 | £10 |
| ANIMATOR | £225 | £25 |
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### MICROLOGY

| | | |
|---|---|---|
| FTNUMB (FORTRAN-80 RENUMBER & REFORMATTER) | £50 | |

### MICROPRO INC.

| | | |
|---|---|---|
| WORD-MASTER 1.7A | £88 | £26 |
| TEX-WRITER 2.6 | £44 | £20 |
| WORDSTAR 3.0 | £294 | £45 |
| MAIL MERGE 3.0 (requires Wordstar) | £88 | £12 |
| SPELLSTAR 1.2 (requires Wordstar) | £147 | £12 |
| WORDSTAR TRAINING MANUAL | | £21 |
| WORDSTAR CUSTOMIZATION NOTES | £59 | |
| SUPER-SORT 1.6: Version 1 | £147 | £26 |
| DATASTAR 1.101 | £206 | £29 |
| DATASTAR CUSTOMIZATION NOTES | | £59 |
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| | | |
|---|---|---|
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| MAILMERGE 3.0 (requires Wordstar) | £74 | £12 |
| SPELLSTAR 1.2 (requires Wordstar) | £115 | £12 |
| DATASTAR 1.101 | £174 | £29 |
| SUPERSORT 1.6 | £118 | £26 |
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| REFORMATTER CPM↔IBM | £147 | £20 |
| REFORMATTER CPM↔DEC | £147 | £20 |

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| | |
|---|---|
| BASIC-80 5.21 | £218 |
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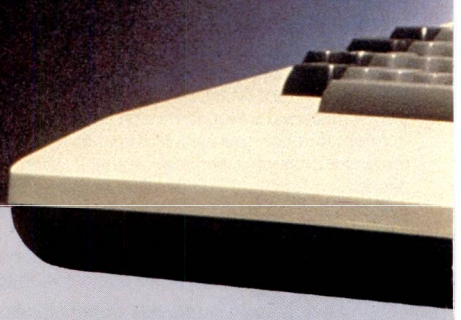
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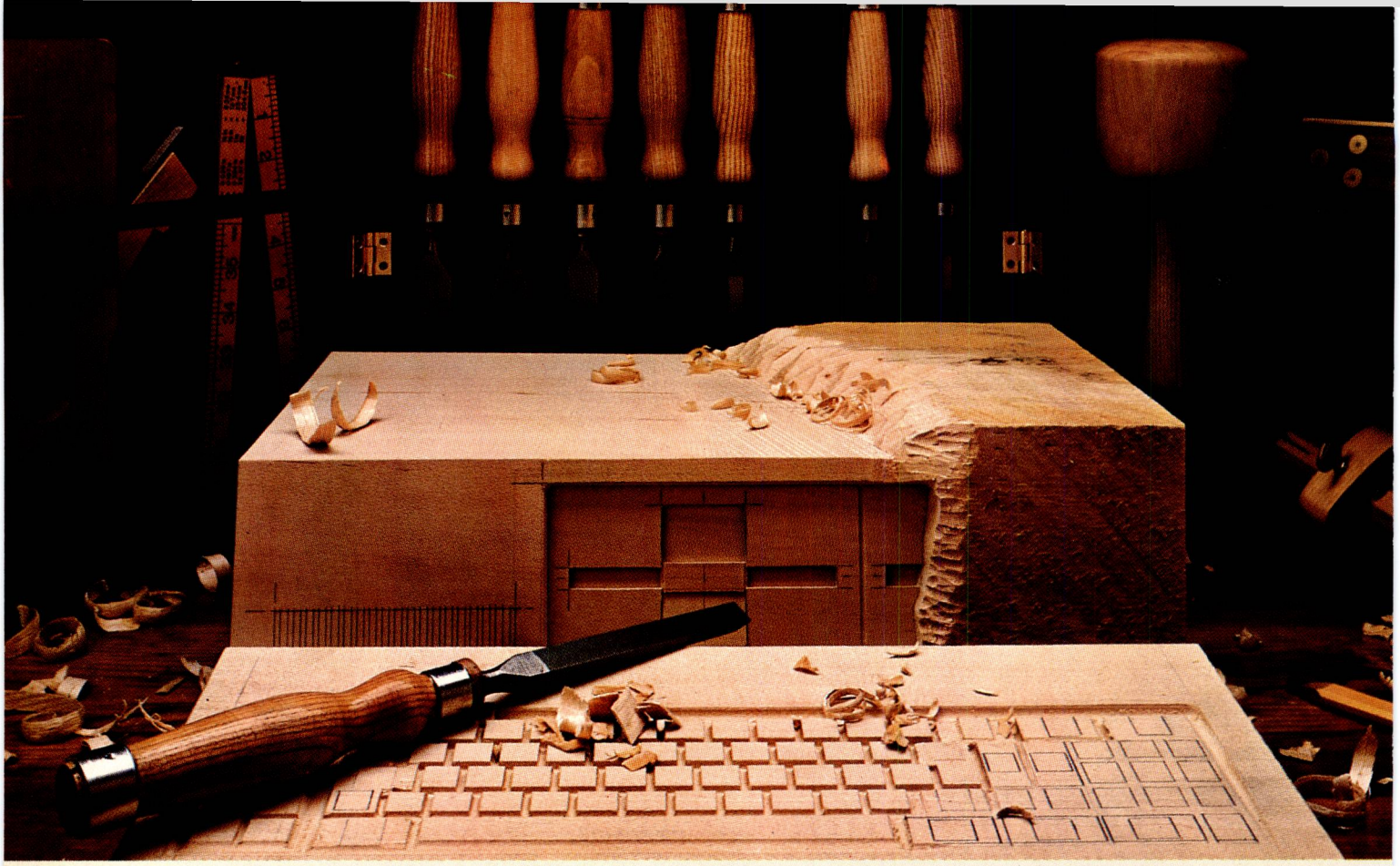
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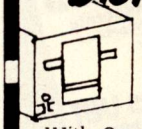
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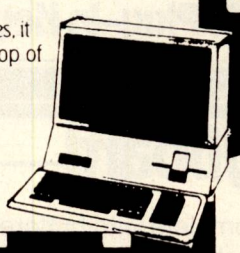
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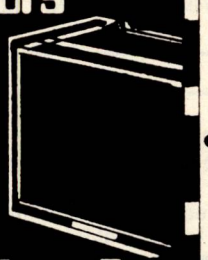
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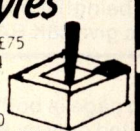
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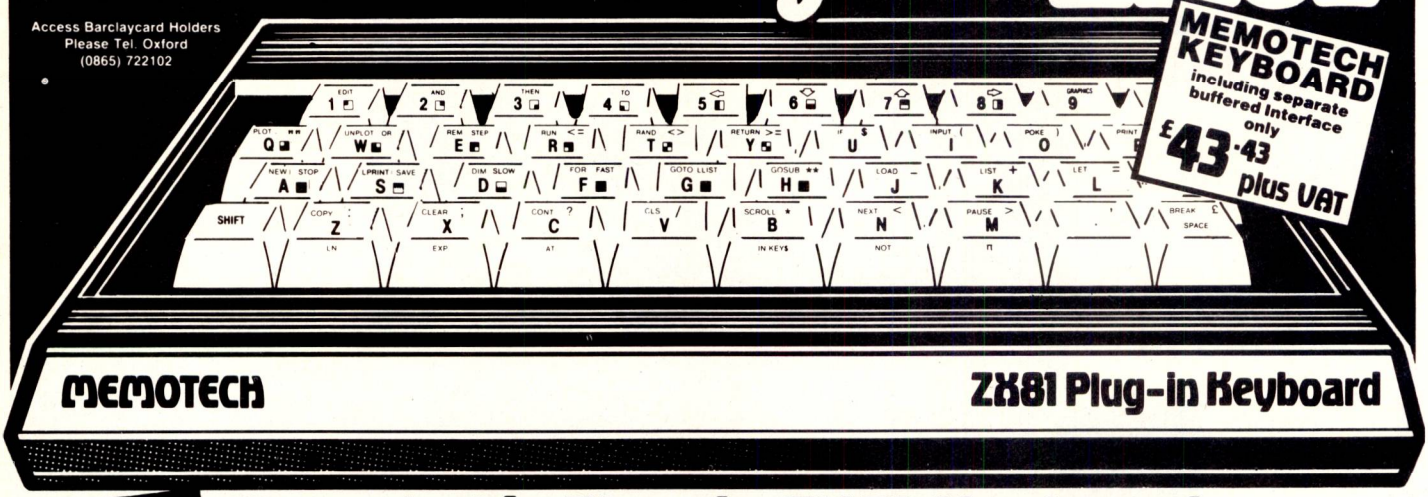
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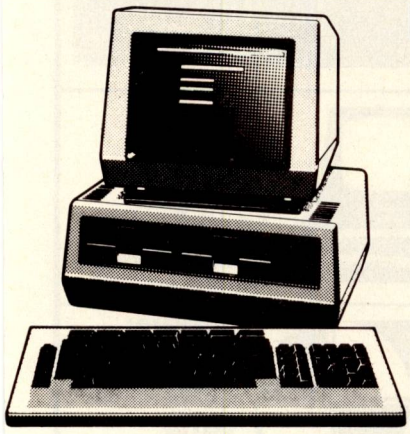
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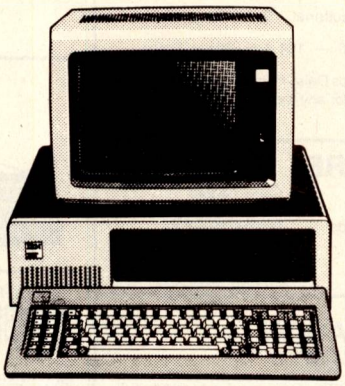


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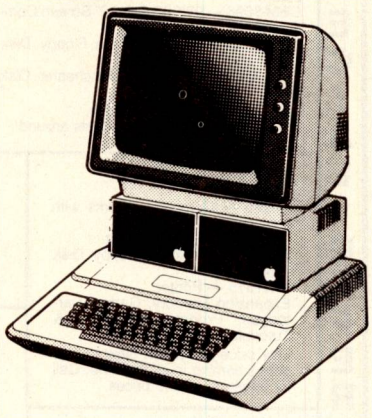
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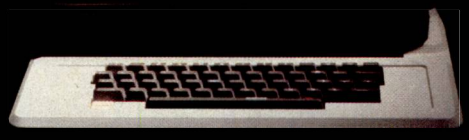
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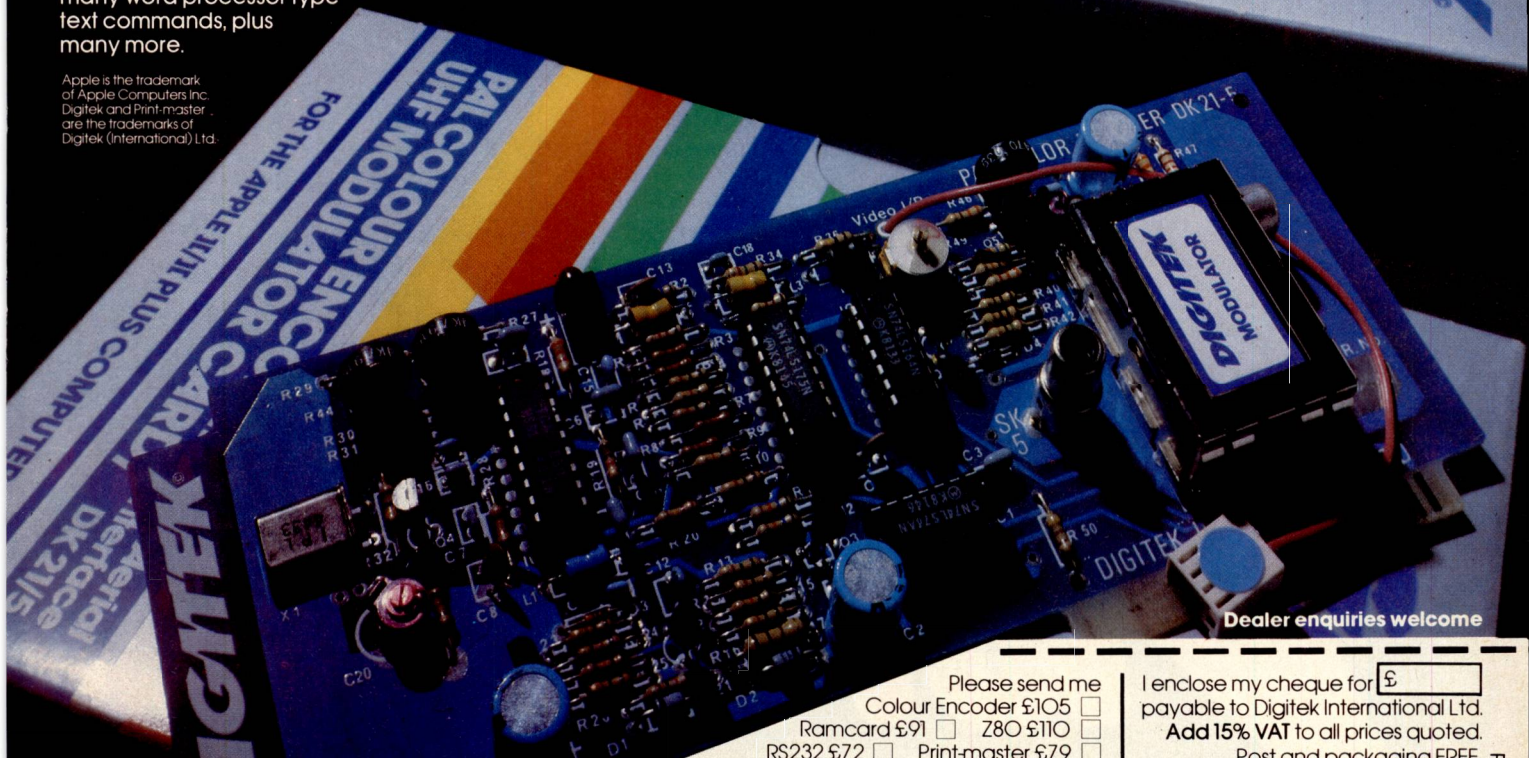
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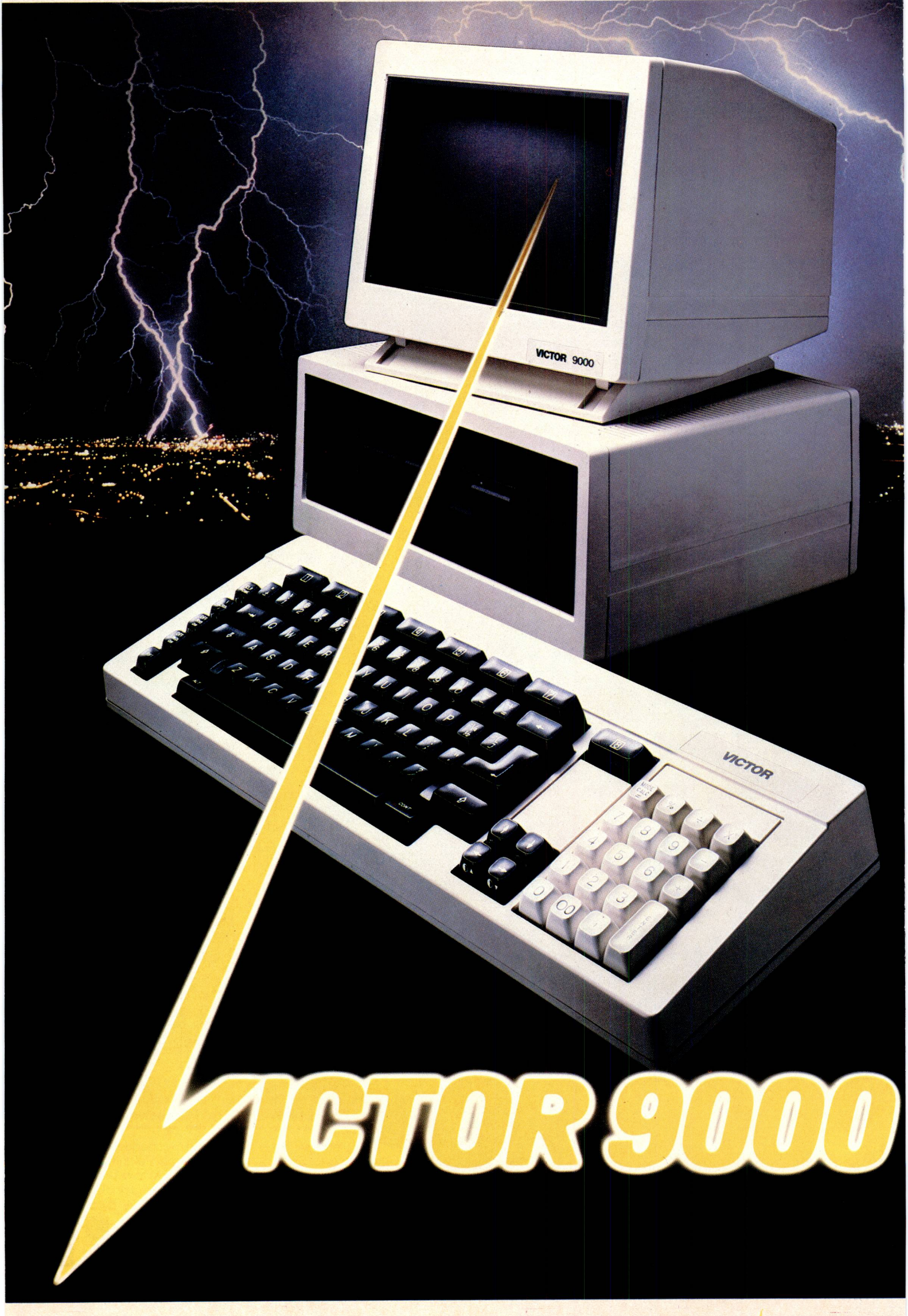
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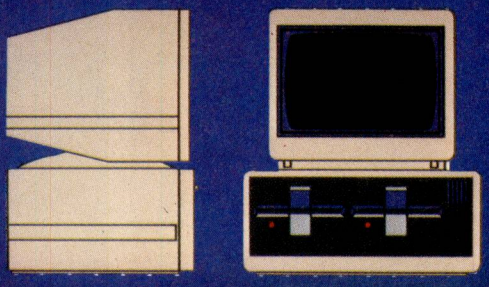
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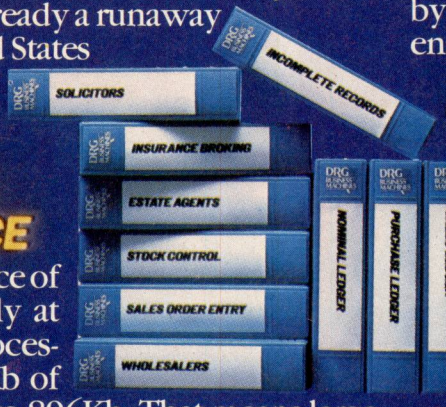
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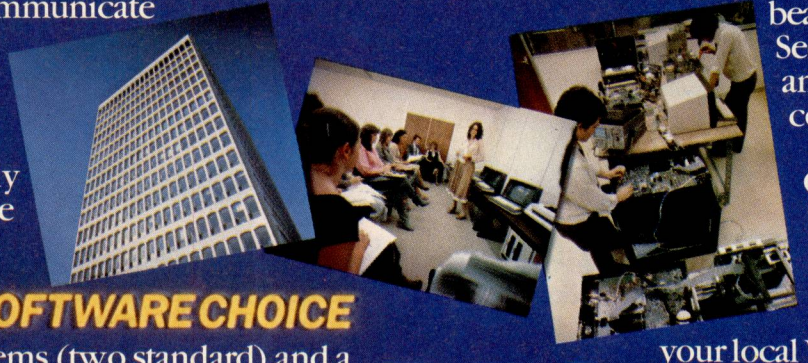
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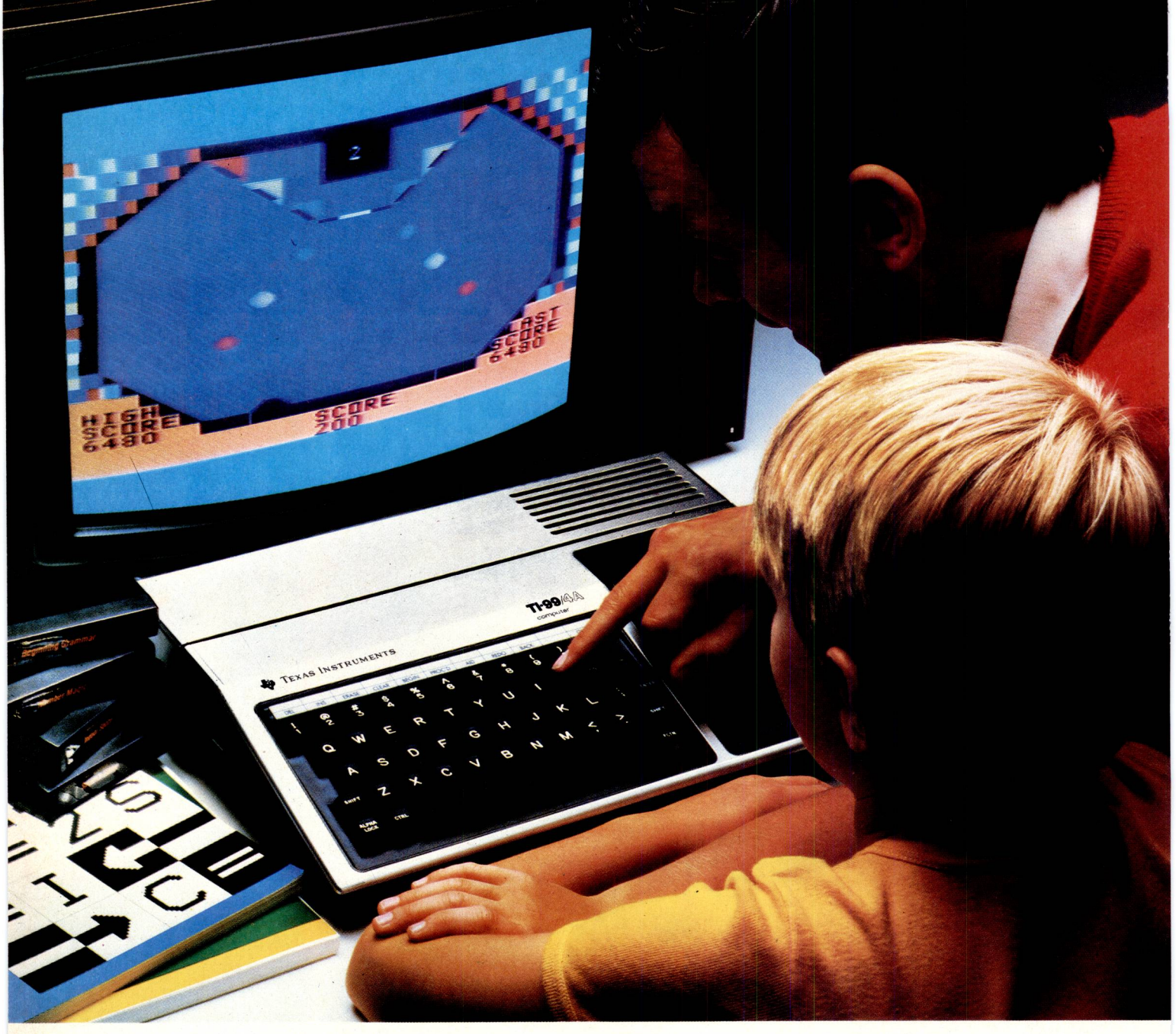


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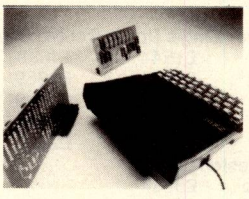
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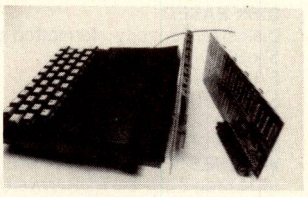


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Time recording package, originally for accountants. Carries forward transactions from one run to the next.
**Time Recording: Graffcom** £400
Excellently documented package which allows for job cost and analysis reports, update and deletion.

## 3. PROFESSIONAL AND SCIENTIFIC

**Scientific Subroutines: TCL Software** £495
A major breakthrough in software for micros in engineering and scientific applications. This is a library of Fortran routines which provides the theoretical analyst with a programming capability which embraces statistics, interpretation of functions, solution of systems of linear equations, matrix computation, integration, differentiation, solution of ordinary differential equations, numerical approximation, solution of non linear equations, least square optimisation, Fourier series evaluation and Fast Fourier transform analysis. More like the NAG library than anything else on micros.
**Sam: Software International** £280
A statistics package with all the usual routines, plus facility for handling missing variables
**Calcstar: Micropro** £120
Financial modelling package linked to Wordstar.
**Editroom** £275
Heat loss calculations for architects and engineers.
**Fastplan: Comshare** £395
An easy to use but very sophisticated financial modelling package.
**Microstat: Ecosoft** £180
The statistics package for micros. Powerful statistics plus a Data Management System for further manipulation.
**Microsurvey: Systematica** £1200
Astonishingly powerful package for survey analysis. Editor for cleaning data, checking ranges and logic. Three levels of hierarchy for data structure.
**Mu Simp/Mu Math: Microsoft** £14
Performs sophisticated mathematical functions whilst keeping track of all 611 digits.
**SNAP-Survey Analysis: Mercator** £65
Designed for use by non-computer staff. Includes questionnaire design & printing, data entry validation.
**Statpak: North West Analytical** £29
A statistics package for the analyst to manipulate and handle data in almost every conceivable manner.
**Supercalc: Sorcim** £18
CP/M improved version of Visicalc, the best selling spreac sheet analysis package.
**T/Maker:** £16
Screen-orientated visual calculating tool. Highly sophisticated and well suited to complex applications.

## 4. BASIC

**TCL DISK BASIC: TCL Software** £5
A compact but powerful 10K interpreter ideal for the beginner because of its ease of use and simple syntax.
**CBasic II: Software Systems** £7
Comprehensive commercially orientated Basic, ideal for business software.
**CB80: Compiler Systems** £31
Compiler for CBasic. Improves Cbasic programs 5 to 10 fold in terms of speed and ability.
**Basic 80: Microsoft** £17
The 'industry standard basic'. A good all purpose Basic with a large vocabulary of statements and functions.
**Basic Compiler: Microsoft** £20
Compiler for Basic 80 which allows run-times which are 3-10 times faster. Allows linking to Fortran and Cobol 80.
**Xbasic: Xitan Systems** £19
A new BASIC with many attractive features: mathematical accuracy, graphics routines for Hi-tech SID1 colour card.

## 5. PASCAL

**TCL Pascal CP/M: TCL Software** £12
This is a powerful, general purpose language suited both to beginners and experienced users. Ideal teaching tool.
**TCL Pascal Pet: TCL Software** £12
Specially designed for Commodore UK. Versions for 3032 4032 and 8032 Pets.

## 6. OTHER LANGUAGES

**C-Compiler: BD Software** £7
This is a powerful, fast, compact, modular implementation and subset of Unix C.
**C-Compiler: Whitesmiths** £47
The ultimate in system software tools. Compiler output in A-Natural source. Supplied with A-Natural.
**C/80: Software Toolworks** £5
New 2.0 release includes full C structures, pointers and arrays all storage classes and data initialisation. One pass C library.
**CIS Cobol: Microfocus** £42
Two versions available, compact and standard, both basec on the ANSI 74 COBOL.
**Cobol 80: Microsoft** £14
Microsoft version of Cobol with relocatable object code.

# CP/M Systems

## THE TUSCAN DESK TOP MICROCOMPUTER

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**SYSTEM CONFIGURATION AND PRICE LIST**
All systems are 60K, 80 x 24 display & include CP/M 2.2
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| 5¼ 8OT/DD | 790K | £1784 | £2179 |
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| 8 DS/DD | 900K | £2310 | £2875 |

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# crosystems

**ıal: Metanic** £145
od microcomputer version of this popular language.
**h: Laboratory Microsystems** £45/£100
od version of Forth for CP/M machines. Two versions able, interger and floating point.
**ran 80: Microsoft** £220
osoft Fortran is comparable to large mainframe :ages. Complies with ANSI stand FORTRAN X3.9-1966.
**ran: Supersoft** £180
Complex variable.
**80: Software Toolworks** £42
interpreter, offers over 75 built in functions including , file I/O and string operations.
**.isp:** £119
ɔcomputer implementation of Lisp programming ıage suitable for artificial intelligence applications.

## DITORS

**80: Microsoft** £69
fast random access text editor. An ideal product to as a programming tool.
**Digital Research** £55
formatter to create paginated, page numbered and ied copy from source text files.
**dmaster: Micropro** £75
prehensive screen based text editor for programmers. superset of CP/M's ED commands, also similar to star.

## PPLICATION TOOLS

**l III:** £295
uces application programs by allowing user to verse" with the computer. Early program generator.
**rt: Structured Systems** £89
sort/merge for files with fixed record length.
**ersort: Micropro** £125
commercial sort for fixed & variable length records ıes data from several files, multiple keys etc.

## PERATING SYSTEMS

**M 2.2 Tuscan Version: Digital Research** £95
sion of this general-purpose operating system able fully configured for Tuscan users.

## COMMUNICATIONS

**nc-80:** £445
chronous communications with any CPU or device that ides IBM support. Error checking.
**MS:** £125
igent terminal program for CP/M systems. Emulates a when hooked up to a host computer.
**AM:** £125
y that permits two CP/M micros to communicate by 32 or modem and telephone line.
**Systematica** £180
nchronous communication to other computers. Micro intelligent terminal, plus ability to download files.

## 11. DEVELOPMENT AND UTILITY PROGRAMS

**Archive: de Gale** £100
Compresses files to less than half size for compact disk storage.
**Compress: Mike Lewis** £29
A package to compress Microsoft Basic 80 code. Makes it more compact on disk and reduces run-time.
**Crash Patch: Elektrokonsult** £70
Powerful set of CP/M utilities. Includes Ddump and Dtest, Unera (unerase) and Ddup.
**UVMAC-Z80: Software Toolworks** £40
Absolute macro Assembler for Z80.
**Text: Software Toolworks** £40
Takes the output from a cheap editor and gives it the appearance of having passed through an expensive word processor.
**Despool:** £50
A utility program to permit simultaneous printing from text files while executing other programs.
**Diagnostics II: Supersoft** £65
Utility for disk testing. Routines to check the VDU, printer, disk drives CPU and memory.
**Disilog:** £55
Disk based disassembler.
**Disk Doctor: Supersoft** £65
A popular utility for disk repair.
**DDump: Elektrokonsult** £35
Dumps file and then reviews by track, sector or block. Possibly the best ever disk editing routine.
**Dtest: Elektrokonsult** £35
Tests and locks out corrupt areas on disk.
**Macro 80: Microsoft** £110
8080/Z80 Macro Assembler, Relocatable, linkable output.
**Forms II: Microfocus** £100
**IBM/CPM:** £135
Allows the transfer of data between IBM and CP/M systems.
**Lynx: Avtek** £250
An overlay linker for creating executable programs from the rel files of Microsoft products. Best Fortran overlay.
**Mac: Digital Research** £73
8080 Macro assembler, with full Intel macro definitions.
**RMAC: Digital Research** £120
Utility for CB80.
**Ratfor:** £42.50
A preprocessor for Fortran.
**Reformatter:** £140
Allows the transfer of data between CP/M and IBM and CP/M to DEC.
**Reclaim:** £50
Helps to prevent loss of valuable data because of defective disk surfaces.
**Restore, Spool, Unspool, Qsub: FBN Software** £45
A set of utilities with functions indicated by the names.
**Smartkey: FBN Software** £45
A package that can be used to redefine keys on the keyboard to represent one or a sequence of keys.
**Smartprint: FBN Software** £45
The same as Smartkey but for the printer.
**Supervyz: Epic Software** £65
A package for creating menu driven options, with messages and prompts, to help with CP/M and other software.
**Sid: Digital Research** £55
8080 Symbolic Instruction Debugger which expands upon the features of the CP/M standard debugger.
**Zsid: Digital Research** £65
Symbolic debugger for Z80 instructions, with Z80 mnemonics.
**Z80 Development Package: SD Systems** £55
Assembler plus editor. Produces rel code.

## 12. MISCELLANEOUS SOFTWARE

**CP/M User Group:**
A range of public domain software, available from TCL Software for disk and copy charge.
**Time Tabling: K. Johnson** £40
Set of programs and a book to perform school timetabling.
**Typing Tutor: TCL Software** £35
Interactive tutor which uses the calculating power of the computer to assess and set exercises.
**Authoring: TCL Software** £30
A small package designed to help non-programmers to write computer-aided programs.
**Estate Agents: Mike Lewis Consultants** £800
Match and Mail for Estate agents.

## NEW PRODUCTS

**Plink II: Phoenix Software** £195
Two pass link editor which supports arbitrarily complex overlay structures.
**PL/1 80:** £325
Application Programming language based on ANSI subset of the full PL/1.
**Pmate: Phoenix Software** £100
Full screen text editor with some unique features. Easy to learn and easy to use.
**XASM-**: Avocet Systems Inc.** £115
A cross assembler for 8080 and Z80 based micros which generates machine code for the Intel 8048 processor.
**XSM 8048** £130
Accepts source code for 8048 and generates object code for 8048 to allow CP/M micros to be used as development tools.
**Ada: RR Software** £350
A subset of the Ada programing language developed by the US Department of Defence.
**Ada: Supersoft** £185
Supersofts version of this highly structural language which is a direct descendent of Pascal.
**Keele Codes (E40): Keele Codes Ltd** £100
A program which compresses files on disk by 40-50%, thus increasing disk space.
**Magic Wand: Peachtree** £250
A popular, easy to use and highly sophisticated Word Processing package based around single stroke control keys.

### Translators for 16 Bit Processors.

**XLT-86** £90
Accepts 8 bit source code and translates it to source code for 8048.
**Trans-86** POA
Similar to XLT-86 but for different machines.
**Act-86** POA
Similar to XLT-86 but for different machines.

# & Software

## MULTI-USER SYSTEMS

Our TS100 Series Card Cage system with CP/M or MP/M with up to four users – choice of video terminals and software compatible with TUSCAN. 5″ or 8″ drives or also available with Winchesters. Contact our Sales Department for further details. Prices from £2302.

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'Star Raiders' is the latest of Atari's video games to become available.

Since it is an ATARI® game we have exclusive rights to exercise all copyrights and other rights connected with 'Star Raiders.'

We lead the field in the development of video games. And it's due to our considerable investment of time and resources that our games have become so popular. And due also, of course, to the people who have enjoyed the games.

Unfortunately, however, some companies and individuals have been copying ATARI games, gaining profits at Atari's expense.

We must protect our investment so we can carry on investing in the development of new and better games.

So consider this a warning both to intentional pirates and to individuals unaware of the copyright laws.

Any manufacture, sale or other dealings in games which reproduce any of the copyrights in 'Star Raiders,' or any unlawful use of the name 'Star Raiders' (or imitation of it) is an infringement of Atari's rights.

Atari will protect these rights with vigorous action against all infringers. Regardless of what computer or other apparatus is used in playing infringing games.

We would also appreciate the co-operation of legitimate software developers in the protection of our property.

And if you happen to be selling a software product which performs a game similar to 'Star Raiders' (or any other ATARI game) please contact us immediately.

Write to the attention of: Graham Daubney, Atari International (UK) Inc., 185 Ealing Road, Alperton, Wembley, Middlesex.

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# ACT

# pulsar

# INDUSTRY-STANDARD 16-BIT BUSINESS SOFTWARE.

The new PULSAR business software is 16-bit software ecially developed for new generation 16-bit personal mputers.

It's inherently faster and more powerful than aditional 8-bit software.

The result: More and more business users are oosing PULSAR, making it one of the industry standards 16-bit personal computers.

Only PULSAR meets the five key requirements for -bit business software:

**RTABILITY**

PULSAR is primarily written in the BASIC portable nguage. So your investment in software is protected, gardless of how often you change your system.

**EDIGREE**

PULSAR has been developed by ACT's own software gineers as a true 16-bit system. And ACT has more than years experience in business software – computer reaux using ACT programs produce more than 3 million atements every year and handle business applications for more than 2000 companies. PULSAR incorporates many facilities that were previously available only on large mainframe computers.

**INTEGRATION**

ACT supplies integrated business software, linking every aspect of business accounting. Now with PULSAR, this integration is taken a stage further with word processing and business management tools able to share information and files with accounting applications.

**USER-FRIENDLY**

PULSAR is really easy to use. Documentation is to the highest standards in the industry, taking the operator step by step through the system. A simple question and answer routine on the computer screen prompts the user at every turn.

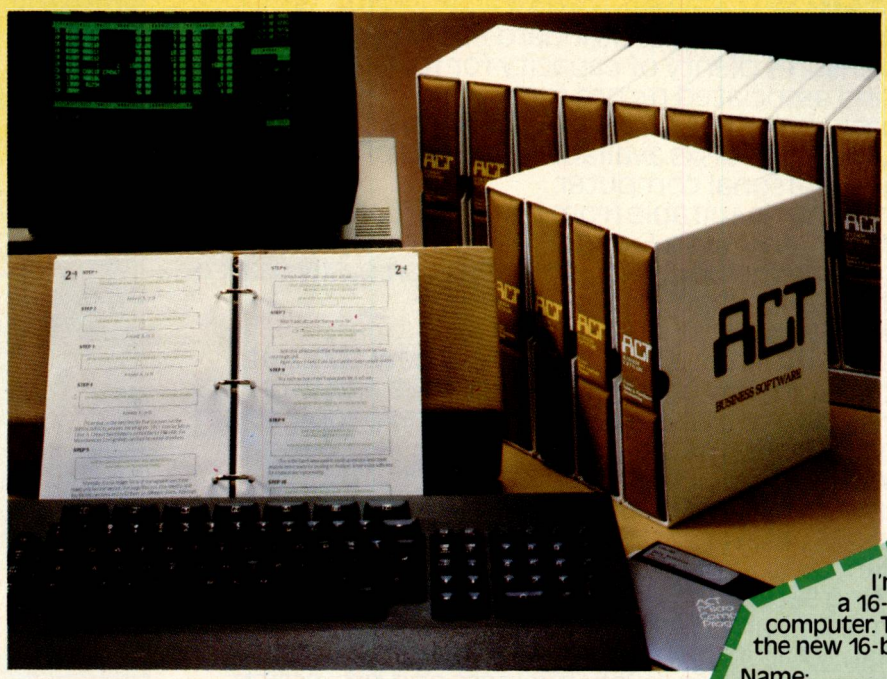
**TOTAL SUPPORT**

ACT is used to providing on-going support for its users. Not only is there a "hot-line" to resolve queries, but also a fully equipped training school open to all PULSAR users.

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**LSAR CCOUNTING**
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**LSAR RDER PROCESSING**
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**PULSAR FINANCIAL MANAGEMENT**
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- Pulsar MicroModeller
- Pulsar SuperCalc
- Pulsar MultiPlan

**PULSAR OFFICE SYSTEMS**
- Pulsar WordStar (word processing)
- Pulsar Mailmerge (mailing)
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pulsar **16 BIT-SOFTWARE FOR 16 BIT PERSONAL COMPUTERS**

The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions. ACT products include personal computers – network micro-computer systems – turnkey mini computers and a total range of services, including software development, computer field engineering, computer supplies, and a complete range of Bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.

For more information on 16-bit Pulsar Software complete the coupon and post to ACT (Microsoft) Ltd., FREEPOST, Birmingham B16 8BR or phone 021-454 8585

# A
# S
# THE 16-BIT PERS

The ACT Sirius 1 is more than the UK's best-selling 16-bit personal computer. It is the only one with such a large choice of 16-bit software — business and scientific programs specially developed to take advantage of the high speed 16-bit Intel 8088 microprocessor at the heart of every Sirius.

Combine this faster and more powerful software with the advanced specifications of the Sirius 1 and you can see why more and more business users are choosing Sirius.

Because Sirius users have both the latest microcomputer technology and the powerful 16-bit software that takes full advantage of it.

Ergonomics plays a vital part in the design of ACT's Sirius 1. The screen tilts and swivels to suit the user and glare is eliminated.

The display is razor sharp, and the brilliance and contrast can be adjusted using keys on the low profile detachable keyboard.

**UP TO 896 KBYTES RAM**

128 Kbytes of RAM memory as standard easily upgraded to a massive 896 Kbytes ensures plenty of capacity for fully fledged business software and associated record files.

Within the basic system is 1.2 Mbytes of floppy disk storage, with 2.4 Mbytes double sided disks available as an option. More than any other comparable personal computer.

As a result, the Sirius is suitable from the start for large record processing applications. And with 5 and 10 Mbyte Winchester disk drives scheduled for early introduction, the Sirius can easily match your own organisation's growth.

**SOFTWARE THAT TALKS BACK**

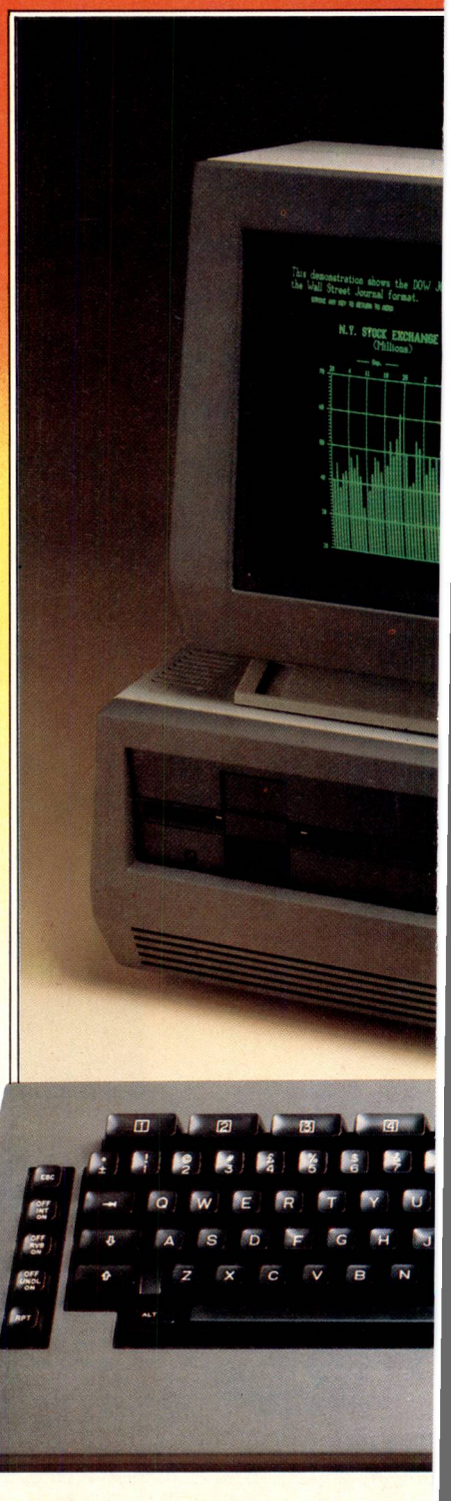
And built into every Sirius is a revolutionary new concept: An audio decoder that can play back verbal messages and prompts under program instruction to assist the non-computer people to get acquainted with the software more quickly.

**NEW 16-BIT SOFTWARE**

All the big names in applications software are on the Sirius: ACT's Pulsar for accounting, WordStar for word processing, MicroModeller for financial modelling and SuperCalc the "spread sheet" program.

Plus the exciting SELECT, the only word processor that teaches you how to use it in less than 90 minutes.

And more than 100 top software companies are currently developing specialist software for every business and profession from the motor trade to solicitors.

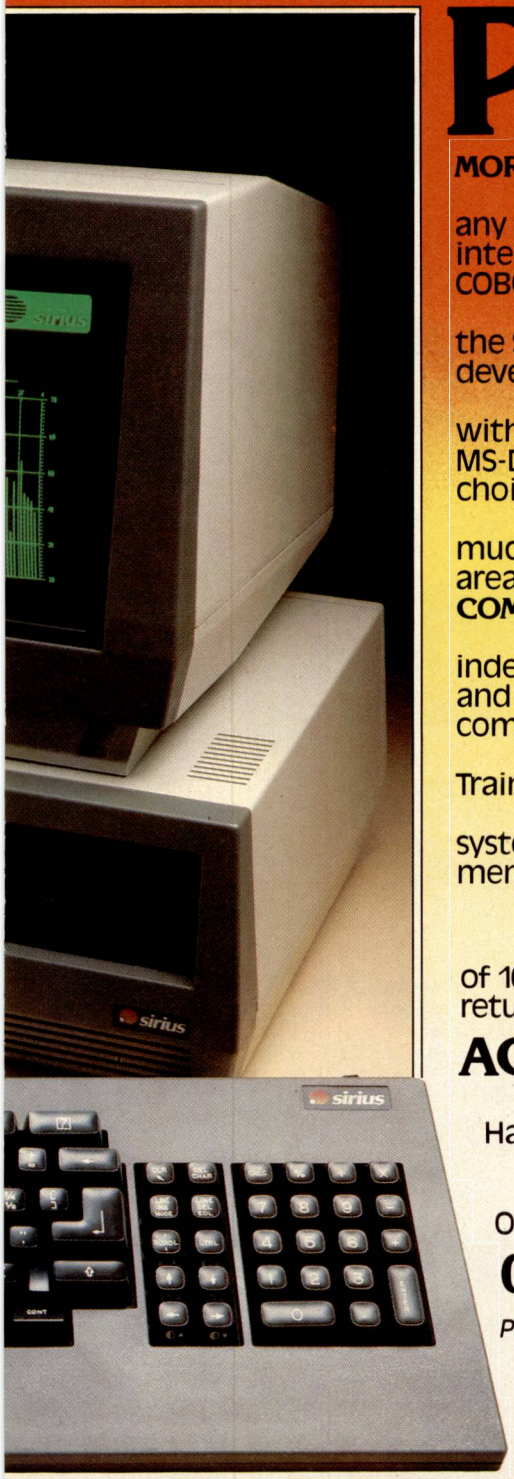



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The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.

# CT
# rius 1
# NAL COMPUTER
# Price £2,395




**MORE LANGUAGES**

The Sirius has more available programming languages than any newly-introduced personal computer. MicroSoft's BASIC 86, interpretative or compiled, CBASIC, a choice of several versions of COBOL, three different PASCAL's and a full scale FORTRAN.

The benefits? Programmers and software houses are making the Sirius their first choice computer for business software development.

Unlike other personal computers, the ACT Sirius 1 is delivered with the two industry standard operating systems at 16-bit level — MS-DOS and CP/M-86. Once again a guarantee now of the widest choice of off-the-shelf 16-bit software.

And further operating systems are under development. The much vaunted UNIX and a new system to support a low cost local area network.

**COMMUNICATIONS**

The Sirius is the ideal communications system, with two independent RS232 communications ports in addition to parallel and IEEE 488 ports. Available NOW are all the facilities required to communicate directly with large, mainframe computers.

Further backing is available by way of a dedicated Sirius Training Centre, run by ACT and open to all.

To support the product ACT has a truly professional network of systems dealers, hand picked for its knowledge of the business environment, enabling top quality support to always be close at hand.

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**PCW/12/82**

# VIC-20 and Commodore 64 from Adda

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Features include: * 5K RAM expandable up to 29K * 8 border colours, 16 screen colours * 8 screen character colours * 3 audible tone generators, each of 3 octaves * a 'white noise' generato * 88 character program line length * 64 ASCII character set * full PET-type graphics character set generated directly from keyboard * 176 × 158 pixels (27,808 in total) maximum resolution * 8 programmable special functions accessed via 4 special function keys.



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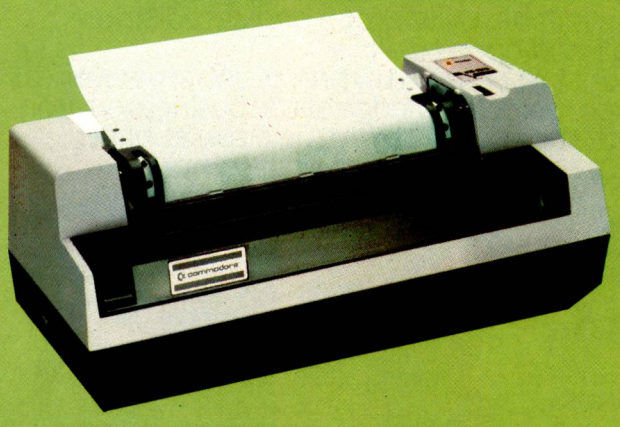
Features include: * 64K built in RAM * 40 column colour display – tv interface * Upper and lower case characters and graphics * Sprite graphics on eight levels * Music synthesiser with three voices and nine octave range * 16 colours available simultaneously * 8 bit parallel user port.

## PRINTER

**£230**
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The VIC Printer – suitable for the Commodore 64 also – will print programs, letters, business data and graphics. It offers high specifications at a competitive price.

Features include: 80 characters per line. Tractor feed dot matrix. 30 characters per second print speed. Full alphanumerics and graphic printing. Double-size character capability. Price includes all cables. Alternative printer **GP100VC** with full-size paper feed **£270.25** inc VAT.



## DISK UNIT 1541

**£299.95**
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For the VIC-20 and the Commodore 64.
A disk unit transforms your computer into a high-speed system ideal for the more serious programmer or small businessman. It enables you to get the best out of your utility programs.

Features include: 170K bytes capacity. Uses soft-sectored standard 5¼" single density floppy disks. Direct interface to computer. Direct compatibility with Printer. Price includes all cables.



**MEMORY PACKS FOR THE VIC-20**
Special plug-in cartridges are available to expand VIC's memory. 3K, 8K and 16K RAM packs plug directly into computer.
16K RAM Memory Pack **£74.95,**
8K RAM Memory Pack **£44.95,**
3K RAM Memory Pack **£29.95**

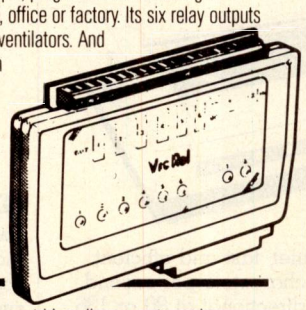
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# FOUR NEW VIC ADD-ONS FROM ADDA

**1.** **Light up with VicRel.** VicRel is a control relay that plugs straight into the Vic user port to give simple, programmable switching of electrical apparatus in the home, office or factory. Its six relay outputs can control door locks, lamps, valves, tools, ventilators. And two inputs allow the Vic to read signals from external sources such as thermostats, push buttons or light activated switches. VicRel eliminates black boxes full of wires and represents one of the most exciting, value-for-money, firmware additions to any Vic computer system.

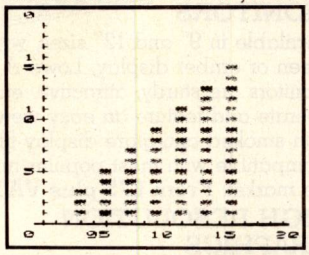



**£28.95** INC VAT

**2.** **Plot away with VicGraf.** This cartridge allows you to explore the complicated equations and functions of graphs. The menu screen, activated by the Vic's special function keys, will automatically plot a graph, define new functions, calculate accurate values of an intersection, find the maxima and minima of a function. Simple editing allows you to check current functions and to change them. A necessary and attractive addition to any educational situation where graphs need to be explored.

**£28.95** INC VAT

**3.** **Crunch & Display with VicStat.** A plug in cartridge that undertakes statistical calculations—such as Meanvalues, Standard deviations and Variances—and displays using single commands. Other one word commands allow you to draw vertical and horizontal bar charts, to plot graphs, and to specify the scales and the colours used by these commands. It will also sort numeric and character strings. Finally, all or part of screen displays can be copied to the Vic Printer.



VicStat comes complete with a detailed operating guide.

**£28.95** INC VAT

## FORTH

The VicForth plug-in cartridge, complete with 3K of additional memory, takes programming into new dimensions. As both an operating system and program development aid VicForth can speed up program writing and speed of operation.
VicForth is based on fig-Forth and is almost identical to Pet Forth. It does however support the Vic cassette deck—an unusual feature. For those who do much programming a Vic Disk unit is suggested. VicForth provides several hundred one-word commands—listed in the detailed user guide—that can be added to.

**£38.95** INC VAT

**ADDA COMPUTERS**
Contact your local dealer for these VIC products from Adda.

adda

In case of difficulty—or to see demonstrations—call the VIC Centre 154 Victoria Road, London W3. 01-992 9904.

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| 5 | Equipment Register | 10 | File Indexing |

Information sheets are available on these applications. Indicate your area(s) of interest on the coupon below.

# FREE - SAVE - £30

With every dBASE II purchased from AQUA before 31.12.82, we are also providing–FREE–a copy of our program–DBFLIST.COM –The easy way of keeping track of all your dBASE II files.

The total cost inclusive of VAT & p & P is £431.25.

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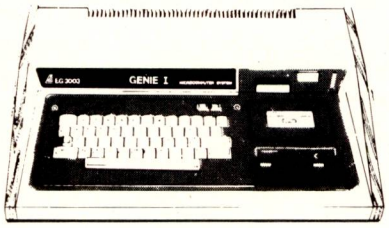
Machine: . . . . . Sheets: . . . . . .

Send to AQUA Computing Ltd, 10 Barley Mow Passage London W4 4PH (01-994 6477) (PCW17)

# Why not spend Christmas with the Genie Family!




## Our ingenious range of small computers, accessories and software make ideal gifts for 1st time buyers or committed hobbyists!

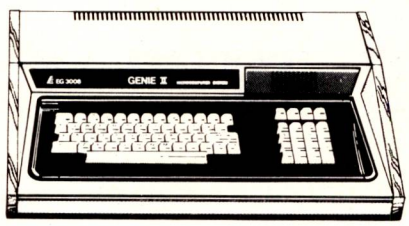



### Genie I

Tried and trusted! – The Genie I is still one of Britain's best-selling small computers, with over 14,000 sold, and it's easy to see why! Software compatibility with Level 2 BASIC means there are literally 1000's of programs on the market ready to run on the Genie, including educational, leisure and small business applications. It's easy to expand, with a vast range of accessories to perform many functions – you only have to read this ad!

Genie I is the ideal computer for the first time buyer, to use at home, at school or at work. The simple BASIC language enables you to write your own programs with ease, and the Microsoft Extended BASIC offers many powerful extra features.

So, if you are not lucky enough to own a Genie I, or if you have a less powerful small computer and want to upgrade, go along to your local Genie dealer, or phone us for advice. It could be your first step into the enthralling world of microcomputers.

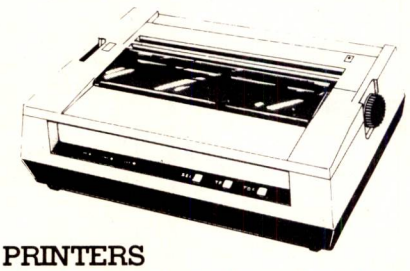



### Genie II

Equally popular and totally reliable! – The Genie II is a breakthrough for small business computers. Harnessing all the advantages of the Genie I, including its low price, Genie II adapts perfectly to commercial functions with the addition of the following features:

**★Numeric Keyboard ★Specific Business Commands ★Four User-Definable Function Keys ★Expandable via the same Genie peripherals ★Extension to BASIC.**

Genie II is an ideal, first-entry, computer for the small business. Corner shops, professional practices and small manufacturers can all benefit from a Genie II business system. For further advice, see your local dealer, or contact us direct!



### PRINTERS

The EG 3085 is quiet, fast and efficient. Printspeed is 100 characters per second and printing is bi-directional at 80 or 136 characters per line. Suitable for use with other systems, it has three typestyles, adjustable pin or friction feed and single sheet or roll paper facilities. **£425 plus VAT.**

If you don't want to pay that much for a printer, consider the EG 603. It doesn't match the EG 3085 in certain areas, but you will still get 100 c.p.s. bi-directional, a range of character styles, forward and reverse feed and pin/friction feed, with 96 characters and 64 graphic patterns.
**£235 plus VAT**



### BROTHER HR-1 Daisywheel Printer

You can now buy a superior daisywheel printer for a price only previously associated with dot matrix models.

The Brother HR is an enticing addition to your system. It has a print speed of 16 cps, range of 8 typefaces, and a choice of two models with either parallel or RS232 interfaces.

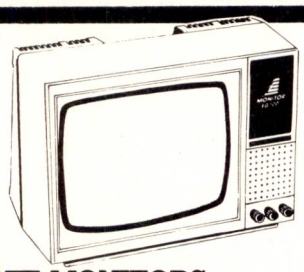
Reliability, durability and attractive appearance make the Brother HR-1 probably the best printer buy this Christmas!

**£650 — VAT**

### EQUIPMENT COVERS

Beat the dirt, coffee spills and sticky fingers when your computer and monitor are not in use with these top quality black leather covers.

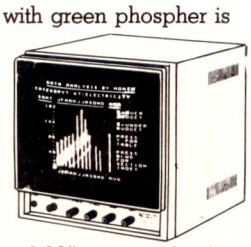
Genie CV1 **£5 plus VAT.**
12" monitors CV6 **£6.20 plus VAT.**
9" monitors CV3 **£4.20 plus VAT.**



### GENIE MONITORS

Two good performance, low priced 12" monitors, either to match your Genie or compatible with a wide range of other systems. Good resolution and band width and, of course, they free your television set for the other type of programmes you like to watch!

The EG 100 12" in black & white costs **£69 plus VAT.**
The EG 101 12" with green phospher is **£79 plus VAT.**



### A.V.T. MONITORS

Available in 9" and 12" sizes, with white, green or amber display, Lowe A.V.T. monitors are sturdy, attractive, easy to operate and feature an easy view screen with smoked anti-glare display filter. Compatible with most popular micros on the market. **From £75 plus VAT.**

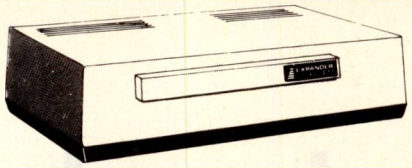
### HIGH RESOLUTION GRAPHICS

Increase graphic resolution capabilities o your Genie seventy-three fold with the LE18 HI-RES unit. It offers bit image graphics of 73,728 points, a resolution of 384 x 192, and uses a separate 16K of video memory to achieve its resolution. Graphics are intermixable with text or existing pixtel graphics, and animation, reverse video displays and use of programmable graphic characters are possible. **£86 plus VAT.**

### TECHNICAL MANUALS

Full technical details of Genie Hardware (all you ever wanted to know about Genie).

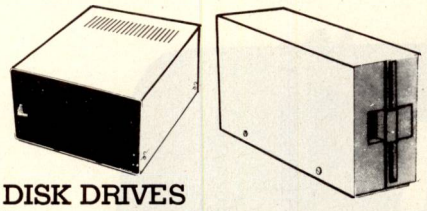
Genie I/II Technical Manual
**£10 - No VAT.**
Expander and accessories (EG3014)
**£10 - No VAT.**



## EXPANDER BOX

The updated EG 3014 expander box allows for up to four disk drives with optional double density. It connects to a printer, or RS 232 interface, or S100 cards. Not bad value at **£190 plus VAT (16K version) or £200 plus VAT (32K version)**

*The EG 3014 will work with TRS 80 by using the EG 3023 Tandy Adaptor.



## DISK DRIVES

If you want fast, reliable program storage, true random access file handling and access to many computer languages, we can meet your needs. The EG 400T provides storage of up to 184320 bytes per floppy disk and comes complete and tested, in a stylish colour matched cabinet. **£220 plus VAT.**

The EG 401 AT offers dual disk drive with 368640 bytes of useable storage and comes complete with a power supply ready to connect to an expander box. **£365 plus VAT.**

## DOUBLE DENSITY ADAPTOR

Allows the use of standard minidisk drives in double density, with virtually double the storage capacity. The EG 3021 is equally at home in the Genie or TRS-80 expander boxes.

A double density disk operating system will be needed, such as smalLDOS provides. **£72 plus VAT.**

## smalLDOS

Powerful, yet reasonably priced, the Genie smalLDOS contains 21 library commands, 7 utilities, LBASIC, disk basic and bags of information, including a reference manual and 40 page beginners guide to disk usage. **£35 plus VAT.**

## BUSINESS SOFTWARE

Specifically written for the Genie II computer, with disks and a suite of packages from the renowned house TRIDATA. The suite includes SALES LEDGER, PURCHASE LEDGER, PAYROLL and STOCK CONTROL. Each package is a very reasonable **£175** plus VAT. Full details on request.

## EG 3203 TANDY-BASHER

If you are a TANDY user, read on! The EG 3203 is bus converted to allow Genie peripherals to be used with Tandy Model I computers. **£18.40** plus VAT.
(Just in case there might be a few strange souls who want to convert in the opposite direction, there is the 50/40 converter which generates a Tandy compatible 40 way bus from a Genie.) **£34** plus VAT.

## FRED MUSIC SYNTHESISER

Beethoven might well roll over at this stereo music synthesiser, it can produce six simultaneous notes over the whole audio range and provide sound effects. FRED comes complete with a software compiler, full instructions and a demo tune. It is simply plugged onto the Genie 50 way bus and has two outputs for an audio amplifier. **£51** plus VAT.

## EG 3016 PARALLEL PRINTER INTERFACE

The EG 3016 is a simpler interface allowing a Centronics parallel compatible printer (EG 603, EG 3085) to be connected directly to the Genie keyboard without the need for an expander box. **£38** plus VAT.

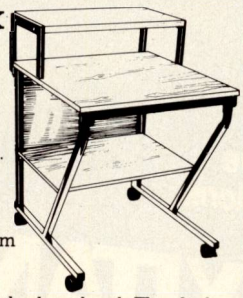
## BUS EXTENDER

A most useful accessory, allows two bus using devices to be connected simultaneously to the Genie – when using the Hi Res and expander for instance. **£21** plus VAT.

## EP1, EP3

Genie I and Genie II have ROMS offering 13.5K BASIC are custom written extensions contained in EPROMs. You can change these as follows:
**EP1** Adds all Genie 1 software facilities to other Genies, lower case driver, machine language monitor, renumber facility, keyboard repeat and screen print.
**EP3** Has HI-RES driver software with 10 extra HI-RES commands which prevent need to load HI-RES software from tape. All at **£12** plus VAT.
For Video Genie Systems, the LE-19 connects direct to the Genie bus and allows one of these EPROMs to be fitted externally. **£26.50** plus VAT.

## SYSTEMS DESK



Even a compact modular computer system like the Genie benefits from being used on a custom designed system desk. The SD1 system desk is designed to accommodate a complete Genie System and has a special upper shelf to support the display monitor at the best level. The desk is flat packed for easy delivery and finished in attractive teak and charcoal colours. **£81.40** plus VAT.

**SPECIAL TECHNICAL GENIE HOT – LINE ON 0629 4995**
for all your technical advice and service back-up on any aspect of the Genie system direct from the experts'




Colour Genie is the latest piece of personal computer magic from Lowe Electronics. Remarkably compact in design, Colour Genie is a powerful piece of new technology which combines all the best features of the popular Genie 1; 16K RAM, 16K BASIC ROM, and full size typewriter keyboard, with the addition of vivid colour, high resolution graphics, 3 channel sound and 40 x 24 screen format – a new dimension in home computing!
Put one in your living room, connect it to a standard colour T.V., and you will be amazed at the worlds that open up for you and your family!
For children and adults, Colour Genie provides an ideal introduction to computer programming. If you fancy a spot of intergalactic travel, or a battle for the planets, Genie will lay on the transport. When you get tired of the kids beating you at Space Invaders, you can always turn their attention to schoolwork. Genie makes that fun too! You can learn typing, a foreign language, or simply keep your household accounts in order.
Of course, Colour Genie is only one of a number of home computers you could consider buying; however, the £199 price tag gets rid of some of the opposition, as do the 64 present and 128 programmable graphic characters! 8 exciting colours leave a few more standing, and four function keys with a built in power supply put Colour Genie way out in front!

## ACCESSORIES

Golour Genie can be supplemented by a large range of optional extras. There is an attractive matching cassette recorder on which to store your own programs, or play pre-recorded software. Joysticks are available for popular video games, and a position-detecting light pen to heighten your colour-graphic creations. If you want to put your machine to work in your business, it can be expanded by a 16K RAM card, and connected to a quality matrix printer via the printer interface and cable.

## SOFTWARE

Colour Genie uses a Z80 central processing unit, and is fully programmable in Microsoft colour BASIC, the most popular home computer language in the Western World!

## MUSIC

Colour Genie contains a FULL MUSIC SYNTHESISER, which will generate a remarkable range of musical sounds through your T.V. speaker, in a variety of pre-settable tempos.

**LOWE electronics**
Chesterfield Rd., Matlock,
Derbyshire DE4 5LE.
Tel: 0629 4995 Telex: 377482 Lowlec G

Please send me details of my nearest Genie dealer ☐ OR The following items:

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# FORTUNE




The Complete 32 Bit **Multi-User** Des

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## Minicomputer Performance at a Microcomputer Price

The FORTUNE 32:16 (TM) is the most powerful and unique microcomputer in its price range. This new system combines the power and computing capability of a minicomputer with the ease of use, convenience and price of a microcomputer. The FORTUNE 32:16 desktop microcomputer is designed for versatility and flexibility in the small to medium size business operation from a one person office to the department of a large corporation.

# 32:16

## Compare these Characteristics

The FORTUNE is based on the most advanced microprocessor available – the Motorola MC68000. Its 32-bit architecture provides significantly higher performance than any other microprocessor in its price class.

| **Features include –** | |
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| * MEMORY | 256K – 1 MBYTE |
| * DISK CAPACITY | 2.0 MB – 80 MB |
| * PROCESSOR | 32 BIT* |
| * MULTI-USER | 16 ADDITIONAL INTELLIGENT WORKSTATIONS |
| * LOCAL NETWORKING | ETHERNET |
| * COMMUNICATIONS | MICRO/MINI/MAINFRAME |
| * OPERATING SYSTEMS | UNIX & CP/M |
| * MULTI-TASKING | SEVERAL BUSINESS ACTIVITIES PROCESSED SIMULTANEOUSLY |
| * COLOUR GRAPHICS | HIGH RESOLUTION 1K x 1K |

* 32 BIT Internal Address Bus 16 BIT External Data Bus.

## Advanced Software

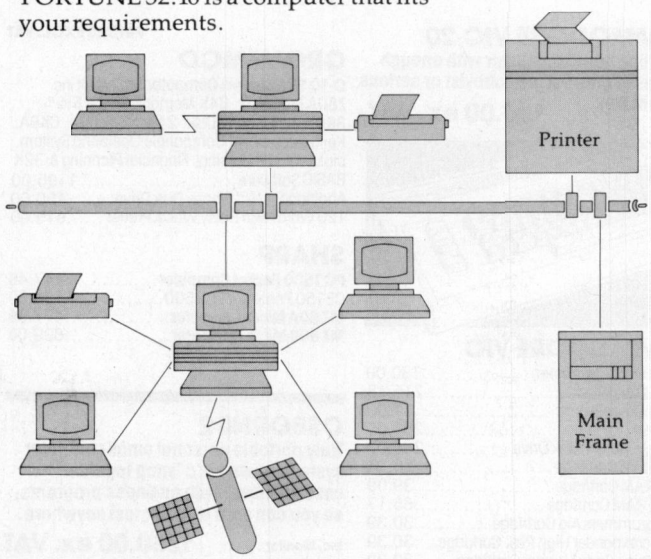
Of course all the features count for nothing if you don't have software and the right level of professional support. It comes with a large range of advanced software with commercial applications tailored to the equipment and allowing the user to learn while using the system rather than referring continuously to manuals to find out what the next instruction to the microcomputer should be. It couldn't be simpler and yet so powerful. No other computer has been launched with more comprehensive software than the FORTUNE 32:16.
WE'RE READY FOR BUSINESS.

## Designed with the User in Mind

The FORTUNE 32:16 is attractive in design, lightweight and easily portable. Ergonomics were a critical factor in dictating all design features. The anti-glare screen is razor sharp and can be swivelled or tilted for user convenience. Attention to detail is evident with the keyboard in the choice of overall colour (to reduce eye fatigue), colour coding of various groups of keys (for easy visual identification), and the varying mounting angles of rows of keys (to reduce hand and arm fatigue).

## For the Expanding Business

The FORTUNE 32:16 can easily and inexpensively be expanded from a single user to a multi-user operation, or expanded even further into a multi-system local network configuration by using standard ethernet (TM) designed by Xerox. In addition the FORTUNE 32:16 can support advanced data communications to other terminals, minicomputers and large corporate mainframes. The FORTUNE 32:16 is a computer that fits your requirements.




## FORTUNE 32:16

The FORTUNE 32:16 is designed for quality and reliability, because downtime is one thing business can least afford. Every major component has been proven in tens of thousands of hours of on-line operation, and each individual unit undergoes comprehensive design, validation and production testing to assure trouble-free performance.

THE FORTUNE 32:16 IS BACKED BY FULL PROFESSIONAL SUPPORT AND TRAINING THROUGHOUT THE COUNTRY.

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The combination of all these features makes the FORTUNE 32:16 the most unique and most powerful microcomputer available in today's marketplace.

The FORTUNE 32:16 is available now at your nearest authorised dealer.

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**There is nothing to compare with it.**

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PCW1

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**A full feature personal business computer system including software – for the price of a VDU. Also the entry point into the renowned Cromemco range.** **1195.00 ex.VAT**



PRICES EXCL. VAT

## CROMEMCO

**C-10 SP Personal Computer** Superpak inc. Z80A Processor, 64K Memory, Single 5¼" 390K Byte Floppy Disk, 24 × 80 Screen, CKBA Keyboard. CP/M Compatible Operating System, plus Word Processing, Financial Planning & 32K BASIC Software ..... 1195.00
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Interfaces and cables for all popular micros available – contact your nearest shop.

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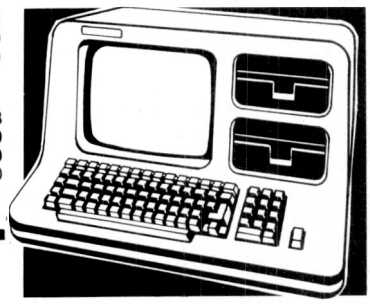
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**Advantage Desk-Top System** inc. Keyboard, Graphics, Screen (Green), 64K Byte RAM, Z80A Processor, Serial Interface, Dual 350K Byte Diskette Drives and Busigraph Software ..... 2195.00
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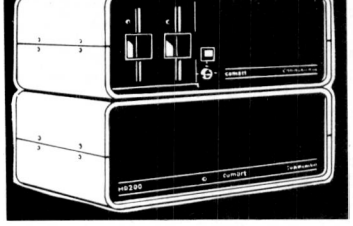


## NORTH STAR HORIZON

**Horizon S100 Bus. Micro Computer** inc. Z80A Processor, 64K Byte Memory, Dual 350K Byte Diskette Drives and DOS/BASIC ..... 1995.00

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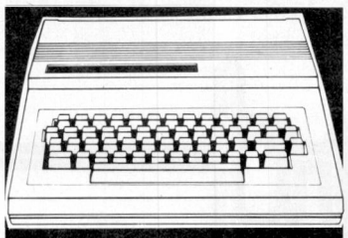
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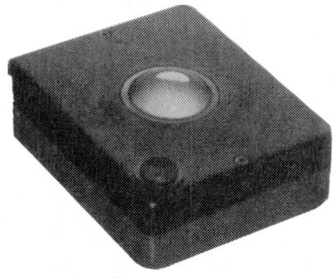
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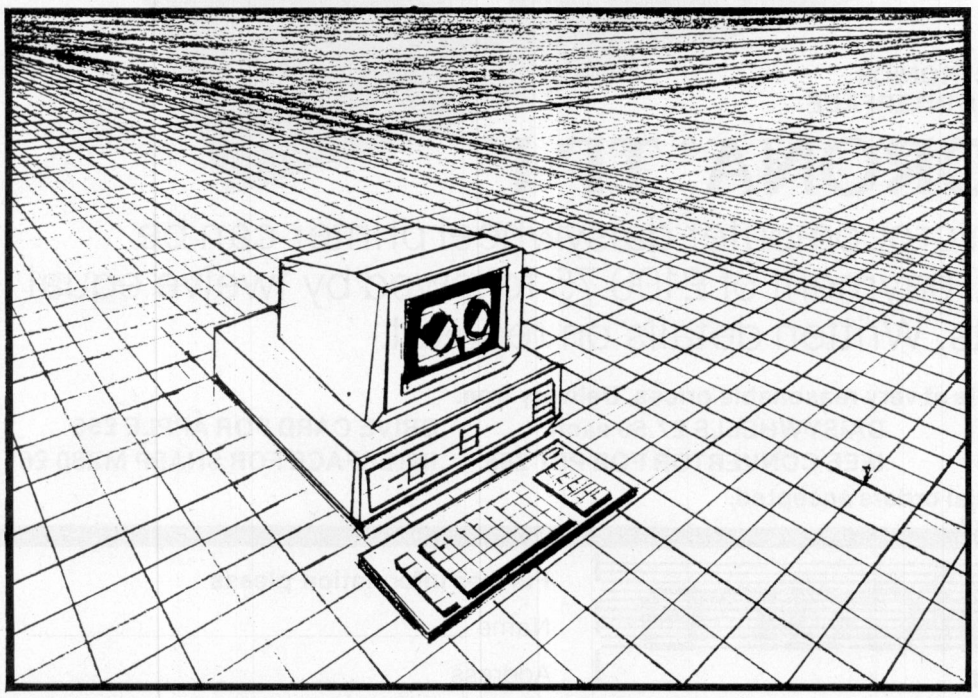
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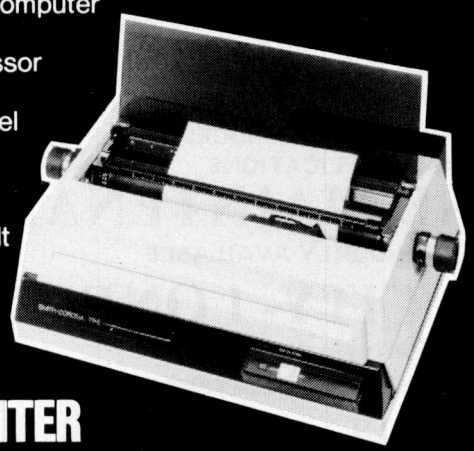
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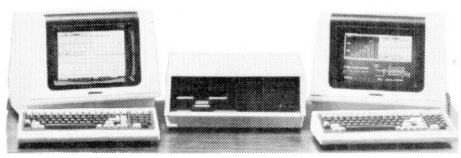
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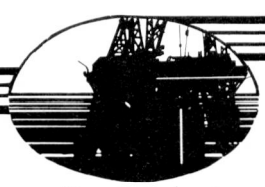
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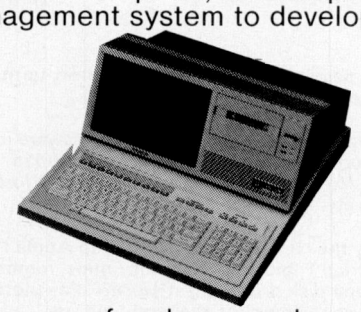
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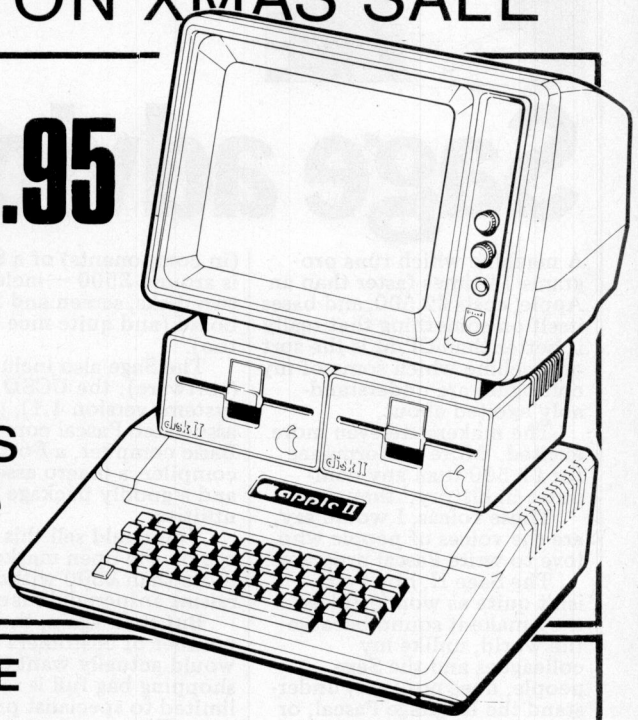
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*Guy Kewney delivers his monthly package of micronews.*

# Sage advice

A machine which runs programs 14 times faster than an Apple, costs £2,500, and bases itself on something that really is better than CP/M is the sort of machine which some of my colleagues are understandably excited about.

The makers are even more excited. 'More performance for £2,500 than any computer in history,' they say.

These voices, I would say, are the voices of people who love to write Pascal programs.

The Sage II, however, isn't quite as wonderful as they make it sound because the world, unlike my colleagues and the Sage people, does not (yet) understand the language Pascal, or the associated p-system 'foundation' of the Sage.

The Sage uses the powerful Motorola 68000 chip as its central processor. It runs (Sage says) 14 times as fast as a standard Apple II.

There are a lot of machines with that chip inside now, and they all share the high price tag.

What the Sage actually is is a signpost. It shows that a computer doesn't have to be vastly expensive, or an imitation of a minicomputer, just because it has a Motorola 68000 processor inside it.

But what it actually is not is cheap.

The price at £2,500 doesn't include a display or keyboard, or printer, nor any usable software.

It does include the means of producing programs which you could then actually use, because it includes compilers for various languages.

The price of any computer is made up of two things — the purchase price of its components plus a profit margin on the one hand, and an extra amount to cover the costs of developing it on the other.

A Sage II computer consists of (hardware): a floppy disk, a circuit board with some chips on it, and some wires and plugs all in a box. The disk is better than some, and there are more chips inside than in some computers. But that said, the difference between this box and the next, in raw materials, is only a couple of hundred pounds.

For instance, the total cost (in components) of a Sirius1 is around £500 — including two disks, screen and keyboard (and quite nice ones, too).

The Sage also includes (software): the UCSD p-system (version 4.1), plus the associated Pascal compiler, a Basic compiler, a Fortan compiler, a macro assembler, and a goodly package of utilities.

You could sell this package on the open market for more than £500 without raising an incredulous eyebrow.

But then again, the number of customers who would actually want that shopping bag full is rather limited to specialist programmers. For them, compilers are essential tools.

For the rest of us, compilers are what we expect the software supplier to use in writing 'real' software — accounts receivable, text processing, stock control, and Adventure Invaders.

And by the time you have bought those, you will find your bill for the complete system ending up very much the same as for a Sirius (or, for that matter, an Apple III — which proves something about the Apple III).

That sounds like a lack of enthusiasm: it isn't. It is just emphasising that we are talking about a system (working) which costs £3,500, and that this is not 'cheap'. In the context of a 'not cheap' computer, the software available is less than thin.

For accountants, things are rosy enough — several brands of integrated accounting software run on the p-system background. They include Systematics, Ormbeta and Jarman brands.

There is only one test editor that Sage's UK agent was able to tell us about: something called an ASE editor 'with sprinter text formatter for technical publications' — something sold by Sage's UK agent itself, TDI.

There are one or two Visicalc equivalents, there is a little comms software, and Micro Expert. And there are some database packages.

I suppose you think I'm making rather a fuss, but I'm still smarting from the injustice of being accused (in print) of 'perpetuating the myth of a lack of software for the IBM PC'. And since IBM itself has so far refrained from releasing its micro over here because it happens to believe the same myth, and since the amount of software for the IBM is a veritable gold-mine compared with the stuff for the Sage there are real grounds for vehemence.

Now, a small surprise for you.

I think the Sage is nearly the greatest thing since sliced bratwurst.

The reason I like it is that it is the first reasonably priced machine to offer the incredible power of the 68000 in as single-user package.

What is the point, you may well ask, of having a 68000, which can solve your problem five times faster than any other chip, and then find some clown has stuck it in a box where it has to service four other people, all on the end of their own terminals, at the same time?

The point of doing that is (since you ask) that there are a bunch of ignorant lunatics who will buy such things, because they see multi-user minicomputers costing £15,000, and the multi-user micro at £8,000 looks like a bargain by comparison.

The Sage, however, (if I ever get one) will be mine, all mine, and nobody else can interrupt my processor and start searching through his silly database for a non-existent order just when I'm trying to do a big file-backup in a hurry.

Somebody out there put a sort of SuperWordStar on it. Please. TDI is in Bristol, and can be contacted on (0272) 742796.

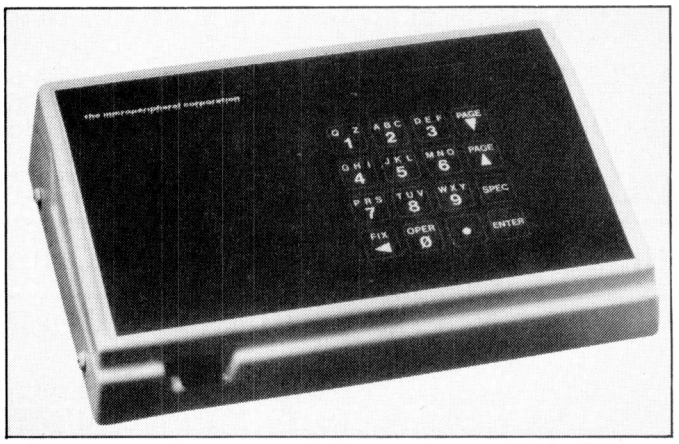
## UK Vector

The arrival of a UK based home office of American system builder Vector Graphic poses an interesting question: how long can 'mainframe' or S100 based microsystems continue to produce big revenues simply because they are cheaper than minicomputers?

Because its systems are not cheap (prices start at £3000 with virtually no software for office applications) each sale is both big-revenue and big-profit.

So the fact that Vector is now only six years old and is already a $36 million operation makes it sound as though it is the micro world incarnate — fast-growing, forward-looking, high technology, micro revolution, and so on.

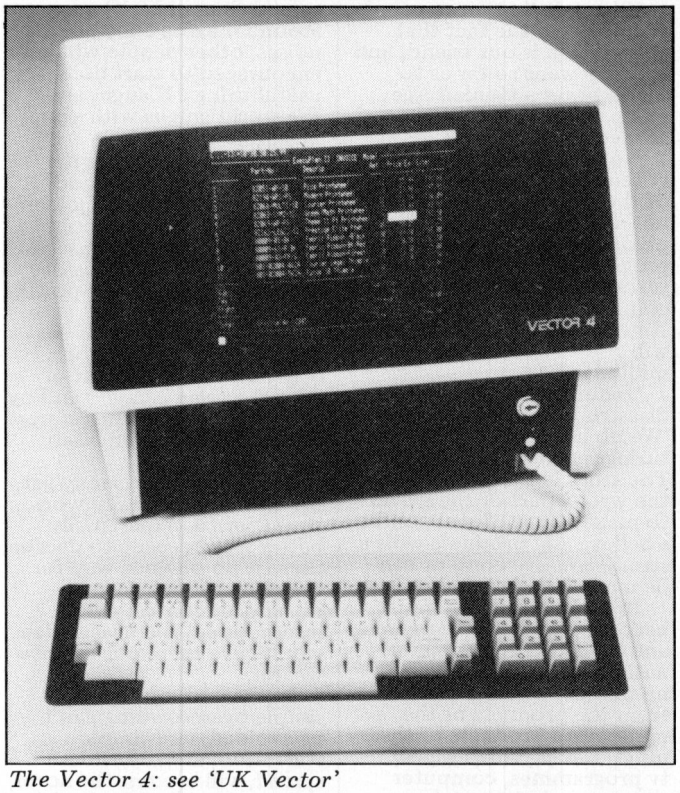
In fact, Vector produces




*The reason this box doesn't look like much of a computer is that it isn't much of a computer. It's a bank window. Microperipheral Corporation in Washington State sells it for $100, so that you can plug it into a television and a phone, and use it to transact business with your bank.*
*It is rather like viewdata systems (Prestel, Telidon and so on) and it only works if your bank has equipment to receive the call.*

*According to Microperipheral Corporation, the box was presented to the recent 'Instant Teller' conference held by City National Bank in Phoenix, and was very favourably received by 90 banking insitutions.*

*I don't want one myself, but I thought it worth noting, since people still do seem to imagine that our Prestel system somehow gives us a two-year lead over the rest of the world — and clearly, it doesn't.*



*The Vector 4: see 'UK Vector'*

standard equipment (in the eyes of many there is no higher praise) that outperforms others by good engineering. It has added to its range by producing a system that runs 16-bit (IBM style) software.

And it provides 'big' systems by putting a lot of ordinary CP/M machines into one box, and making it look like a multi-user mini — because there are a lot of people out there who will buy such a thing, even if they really want a lot of ordinary CP/M machines.

The new company (Vector in Europe) has a new product (the Vector 4) which uses the same micro which runs the IBM and Sirius and DEC Rainbow machines — the Intel 8088.

It can run CP/M and CP/M-86, if it wants to. It looks good in an office. It is (to my mind) not underpriced, but not astonishingly overpriced, either — and in this world it looks like good value for money by comparison with a lot of systems.

But, the question is: can those other systems stay around for comparison? Can the run-of-the-mill S100 system compete with Rainbow and IBM designs, which are cheaper, more glamorously attractive, and carry the magic labels of their builders?

It's a question which doesn't concern Vector directly, but the other S100 system builders, all facing the same question: what can they offer the 'user with a bigger cheque-book' that can't be got cheaper on systems around £1,000; or how can they keep up with the marketing strengths of the big IBM and DEC dealers?

My own opinion, for what it's worth, is that the multi-user market (both multi processor and multi-taking systems) will continue to flourish, despite its obvious lack of fundamental logic, simply because the network world is dragging its feet.

And as long as it does, Vector will shine brightly by comparison.

Eventually, as with the big Vector sytems, we can all link the machine of our choice into a chain of identical 'modes' on a network, rather than buying a central processor and attaching terminals to it.

It will be very interesting to see how the 'central box' approach is received in the market when that happens.

Vector in Britain is in Windsor, at Vector House, William Street, Windsor, Berks SL4 1BA; phone (07535 69375).

## Prizes, prizes

There is no shortage of people offering prizes for software to do with education, is there?

There are usually only two reasons for doing this — either publicity, or simply the software itself.

In the case of Apple's Young Programmer of the Year contest (closes end Janauary) the unusual prize of an Apple II with colour display is offered to the best program of 500 words (?) or less in length, written by somebody who doesn't turn 20 until 1983.

In the case of Micronet 800, the reason is software — the network wants to supply it to network subscribers (that was the whole point of the network after all) to encourage them to join.

For Apple, the real prize is to prove that the machine is unusually suitable for educational work. 'Programs will be judged by a panel, looking for strong relevance to education,' says Apple.

It doesn't just want one program, either — there are 300 runner-up prizes, 50 of assorted books and software, plus (a dead giveaway) '250 copies of the book for programmers and users, *An Apple for the Teacher* published by Sigma'. There are 1000 wall posters printed already, 'suitable for educational establishments and shop premises', publicising the competition.

Both these groups are playing it straight: if you submit a program, you keep copyright and can negotiate it for a fee. Not everybody is quite so straightforward, and there have been competitions in the past where the entrants were merely providing the organiser with a mass of free software.

Apple is at the Education Department, Apple, Eastman Way, Hemel Hempstead, Herts HP2 7HQ. Micronet 800 can be contacted on Peterborough 265666.

## A likely tale

I know it can't be done — but the idea of turning the Sinclair ZX Spectrum into a 'powerful nine octave electronic organ' so appeals to my sense of humour that I just had to pass it on.

The claim is by PDQ Software of Edenbridge, Kent. The product which performs this miracle is not (as you might suppose) a powerful amplifier, set of synthesisers and other audio hi-fi stuff, but a program.

What the program does is to pick up your touch on a Spectrum key, and do the hard work of calculating a BEEP statement for you. It then BEEPs that note, displaying a picture of the note and the BEEP number on the screen.

With the program comes a keyboard overlay, so that you can see which note is on which key, and how to change octaves.

But not with the program (at £6, what do you expect?) is anything to make the Spectrum play more than one BEEP at a time, nor anything to guarantee that you will be able to hear the damn thing, anyway.

Spectsound (the name of the program) is worth buying for one thing alone, however: with it you get a BEEP chart. This converts notes to BEEP numbers, and vice versa.

Details by mail only: money or queries to Parsley Rye, Hilders Lane, Edenbridge, Kent TN8 6JU.

## Beeb aids

At the moment, there is no program to run on the BBC Computer which helps you draw graphics, edit them, and move them around memory.

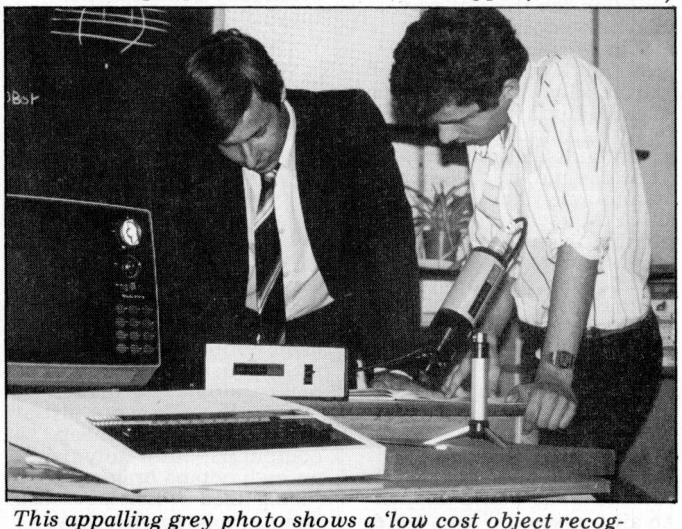
There is, in the meantime, a series of paper aids, with graph paper that helps you keep track of odd bits in memory.

There is also a flow-chart pad, symbol design pad, and a series of binders to keep them all in.

Details from Intastor Micro Aids, Freepost, Stroud, Glos GL6 1BR.

## CP/M Fair

The idea of a CP/M Fair must be absolutely unique in the history of computing. It is going to happen, nonetheless,



*This appalling grey photo shows a 'low cost object recognition system' using a BBC Microcomputer.*

*It is built by Digithurst, in Royston, near Cambridge, and here it is trying to prove that it can recognise the spanner which the television camera is focussing on, as a spaner.*

*The system also works with Pet and Apple hardware. Cost including software but excluding the central micro is around £2,000. Details and a better photo from Peter Kruger on Cambridge (0223) 208926.*

in January in San Francisco.

Previous gatherings of like-minded user groups have always centred on a language or a machine — and, mostly, the languages on one machine have been different enough from those on other machines to keep IBM users from discussing Cobol with Honeywell or ICL people.

CP/M, however, is an operating system which is not native to any one machine more than any other. The problems which CP/M software designers have vary from machine to machine, but still have more in common with each other than they have to distinguish them.

The scope of the show is enormous. Over 200 exhibition stands are planned, and these 'will show the full spectrum of application packages, development aids, microcomputers (how did they get in there?), peripherals, accessories, publications and services available to CP/M users.'

The strength of the show is at the same time its weakness.

The strength lies in the fact that this is an 'official' CP/M show, with Gary Kildall himself (the inventor and designer of CP/M and boss of Digital Research which sells it) plus people like Tony Gold, founder of the CP/M Users Groups and of Lifeboat Associates, and people like Adam Osborne, who swears by the system and sells a machine which runs it.

In other words, the people who can answer your questions will be there.

But the weakness lies in the fact that the dissidents will not be invited to speak. The organisers will claim that there is no point in having dissidents at workshops, where people are trying to get things done, not question the basis of why they need doing.

The organisers will therefore fail to consider ways of moving CP/M away from its dreadful limitations.

By limitations, I don't mean faults. Digital Research, at press time, was planning to announce a new version of CP/M itself, supposedly eliminating many of its known faults, but those faults aren't the important limitations.

Limitations of CP/M are all derived from paper. CP/M is a standard, and it assumes that you may want to talk to a CP/M machine from a remote teleprinter.

The effect of this is a catastrophe on a comparable level to what would happen to air transport if laws were passed insisting that aircraft should be capable of pulling trains through tunnels.

You can't say this, however, to a CP/M believer. To such a one, the fact that CP/M is a standard is all, and if the standard implies a lowest common denominator, so be it.

Yet without this assumption, we would have had concurrent screens, because there would be nothing to stop them. We would have global, relational data structures, because you could look at them. We would have flexible screen formatting, we would eliminate dual terminals, we would have screen editors, and we would have soft keyboards and screens.

Anyway, that isn't what you will get at CP/M-83, which is the name of the exhibition and conference.

For what you will get, contact Digital Research, or Northeast Expositions Inc, which is contactable at 824 Boylston Street, Chestnut Hill, Mass 02167. Phone, if you like, (617) 739 2000.

The exhibition runs from January 21 to 23.

## Wider VIC

Commodore is now preparing for the day when it stops selling the VIC-20, at £160 or so, and tries to make people buy the Commodore 64 at £300 or so — and of course there will be those who will still carry on wanting the VIC.

However, they will quickly come to realise that 23 characters spread across the width of a television screen are 23 very fat characters, and very hard to read.

Dutch firm Computer World (no relation to an American computer newspaper of the same name) has produced a little plug-in circuit which gives the VIC either 40 characters or 80 characters per line of screen. VIC users will be impressed.

However, since the add-on costs the best part of £150, it is possible that they will eventually come to wish they'd just bought the 64 right away.

Details from Holland at Hilvertsweg 99, 1214 JB Hilversum, phone (035) 12633.

## From the horse's mouth

The next fifteen years, thinks Clive Sinclair, inventor of the ZX range of micros, are likely to be a turning point for our civilisation, when computers provide us with the means to real freedom.

Clive Sinclair is not just a rich man who sells cheap computers, but a fully paid-up high octane brain user (being head of British Mensa) and optimist or visionary.

As a consequence, the BBC2 television programme *Futures* felt he was a good person to put on display when they needed somebody to explain why the world might feel warmly welcoming towards microcomputers.

Clive felt that more people should grasp the fact that automation is our friend, and actually went so far as to suggest that a Golden Age might be just round the corner.

Not everybody will instantly recognise his vision as one of the Golden Age — at least, not at first, because the first prediction he made on the programme was that manufacturing jobs in Britain are going to drop still further. And unemployment, he said, will rise to at least seven million.

'Daunting this may be; disastrous, not,' he said. 'We do not need a manufacturing industry to be wealthy. The truth is that Britain is in the wrong part of the world to make conventional goods. I believe any products with a strong creative content can be made here profitably.'

In other words, we must become a nation of designers, and let the low-cost labour nations become producers, he thinks. 'We must turn from the products of the material to products of the mind; books, video-tapes, tv programmes, computer programs, design services, consultancy of all forms.'

In such ways, seven million jobs, creative, enjoyable and rewarding (and highly paid) jobs can be produced by the 1990s, he says.

Behind this (I think) dubious theory lies Clive's unstated belief that if people whose opinions are generally valued (like himself) go around making encouraging noises, other people will be encouraged to start doing useful things. 'Laugh, and the world laughs with you,' in simple words.

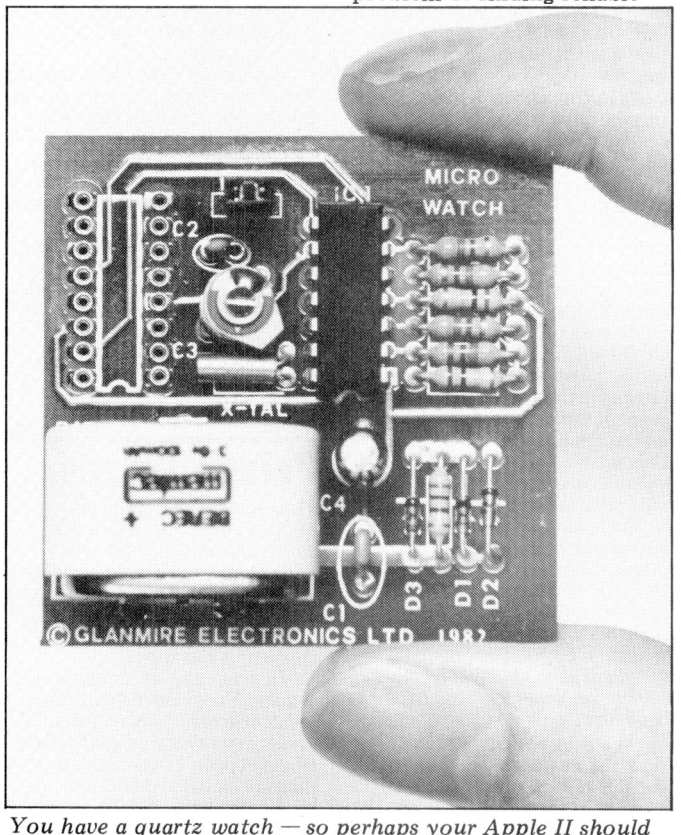
Oddly, perhaps, I agree that things in Britain and Europe will get more golden rather than less (no doubt Clive is delighted to hear me say so) but not because of our creativity, nor the power of infectious giggling.

The vast majority of humanity is bitterly poor, living on the equivalent of a bowl of rice a day — and by comparison, even the poorest Westerner is an immensely rich person.

And while things may get, for a time, marginally worse, then (perhaps) marginally better from decade to decade, there is no obvious way for the poor nations to gain the sort of control over international finances which would give them our relative wealth.

In the end, of course, simple overcrowding can't be avoided, and simple starvation, already widespread, will become the norm, and eventually there will be a plague.

We, in our Golden Age, will send blankets, and will tut-tut over the difficulty of getting reliable sub-contractors to build cars and computers, in their low-wage economies, the way the rich always grumble about the problem of finding reliable




*You have a quartz watch — so perhaps your Apple II should have one too. It'll also want the software needed to read the watch. The Micro Watch (a real-time clock card) and an Electronic Diary program which uses it, are both available from Glanmire Electronics, of Cork. Contact them on 128 Oliver Plunkett Street, Cork, or phone (Eire, remember) 021-500418.*

# Still Need Convincing?

| SOFTWARE FACTSHEET | |
|---|---|
| Product: **CARDBOX** | Type: **CardIndex** |
| Retail Price: **£155** | Machine: **CP/M & MP/M** |
| File Size: CP/M **8MB** MP/M **16MB** | Records: **65,500** maximum |
| Record Size: **1404** ch maximum | Fields: **26** maximum |
| Field Size: **1404** ch maximum | Index Limits: **None** |

Notes: Allows **complex searching** using up to **99** separate **criteria**.
**Widely available** from **distributors** in USA, [illegible] Australia.

Published by **Caxton Software** Ltd of **London**.

# The Critics Don't....

**"Cardbox is your familiar, tried and trusted card index...with most of the features you have always wanted on your manual card index but couldn't have, because of the limitations of pieces of card."**

**"Cardbox...succeeds extremely well. Its facilities for indexing and searching are good and very fast...the user image of the screen displays and the documentation are in the main excellent."**

Personal Computer World, August 1982

**"The interesting thing...is the display...Cardbox enables you to draw a form on the screen complete with headings."**

**"Cardbox is an excellent database manager...its versatility...and its ease of operation make it a useful program for home or business."**

InfoWorld, September 13, 1982

**InfoWorld**
**Software Report Card**

***Cardbox***

| | Poor | Fair | Good | Excellent |
|---|---|---|---|---|
| Performance | ☐ | ☐ | ☐ | ☑ |
| Documentation | ☐ | ☐ | ☐ | ☑ |
| Ease of Use | ☐ | ☐ | ☐ | ☑ |
| Error Handling | ☐ | ☐ | ☐ | ☑ |

**Anyone can use Cardbox. It's a simple yet powerful electronic card indexing system. Easy to learn and easy to use, Cardbox is bringing real computer power to hundreds of new users.**

**Put yourself in a user's shoes:**

You wouldn't have to change your present working methods or think in computer terms. Cardbox talks to you in plain English.

If you can do it with a card index you can do it better with Cardbox thanks to its sophisticated automatic cross-indexing.

Up to 65,500 'cards' can be stored and they can be displayed, printed or passed to other programs in any number of alternative formats.

- Groups of 'cards' can be selected by any word in any field. Your choice can be refined by using up to 99 words in a single search.
- Information is easily added, changed, duplicated or deleted.

**These are just a few of the reasons why the top British and American micro journals are convinced Cardbox is the ideal card index for CP/M users.**

# Cardbox - the ideal card index system for CP/M users

**Caxton Software Ltd,** 10-14 Bedford St, London WC2E 9HE. Tel: 01-379 6502. Telex: 27950. Ref: 398

Caxton products are available from leading microcomputer suppliers in the UK.

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Please send further information. Business Card attached ☐

Please send _____ copies @ £157 + VAT (includes P+P)

A cheque for _____ is enclosed.

Caxton

servants.

But the majority of humanity will continue in grinding poverty. The habits of the last three thousand years aren't about to end in a couple of decades just because of the microcomputer.

Unless, of course, it is the microcomputer that presses The Button.

## Howzat?

An unusual claim to fame by a software writer: Microchat of Penistone in South Yorkshire is into cricket and rugby, producing the software which drives the Headingley scoreboards.

'We maintain we can write software for any application on virtually any machine,' they say — the scoreboards were controlled by a Hewlett Packard HP-85, and they did a marathon scoring system on an Apple for McEwan's Lager, and an insurance system, and a joinery job costing system.

Getting someone to write your own software is not normally a good idea on a micro, but if you must, I suppose these are unusual enough credentials to warrant a mention.

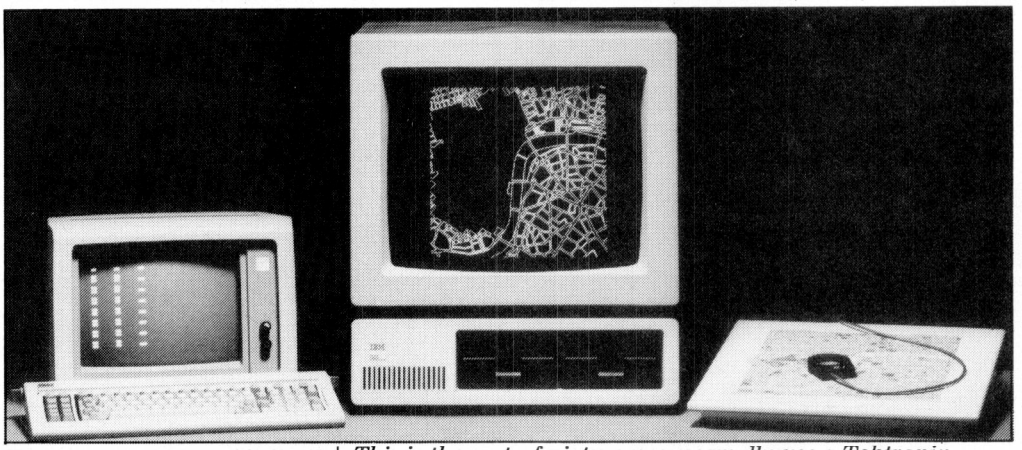
Microchat is on (0226) 765927.

## Saving scrap

Horrible old Teletype printers, for which people used to pay nearly a thousand pounds because they were the cheapest sort of printers you could get, are nowadays sold as scrap.

For users of cheap Sinclair ZX machines, however, those romantic clanking ruins are worth salvaging from the scrap heap, and are usable to record things that the machine produces, on paper.

All that is needed is an interface — something to connect computer to printer.



For £19.50, plus an additional £2.50 for a bit of software, this is now available from Softest, 10 Richmond Lane, Romsey, Hants SO5 8LA.

*This is the sort of picture you normally use a Tektronix screen to generate. Here, it is being done with an IBM Personal Computer on a screen and graphics tablet from Computer Displays Ltd.*

*It may give you something to do with an IBM PC (all you need is the PC!).*

*Agent is Riva Terminals: details on Woking (04862) 71001.*

## Market gardening

Despite the fuss that 16-bit machines are causing, software house Peachtree obviously thinks that it is more significant to be able to run its accounting programs on the Apple II for the first time, than on the CP/M-86 family.

At the moment, of course, the programs will probably run on any IBM Personal Computer you can get your hands on, but Peachtree isn't going to say that, for fear of offending IBM.

So the company refers coyly to 'CP/M-86 16-bit machines including the Sirius 1 and Victor 9000' (identical machines).

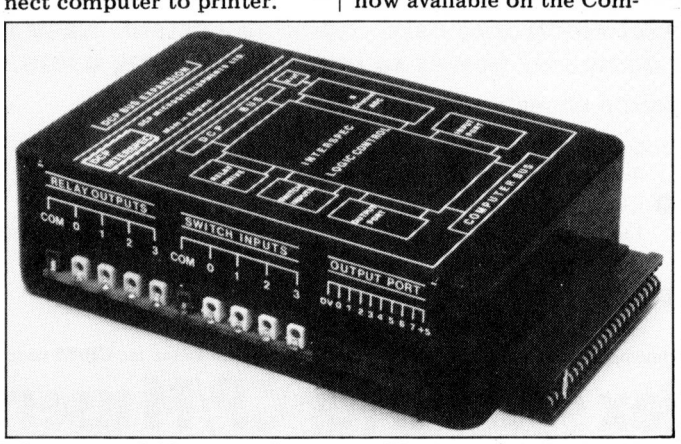
The programs are all written in Microsoft Basic. Details on Maidenhead (0628) 71011.

## Comspeed

To anybody with a Commodore machine, the simple statement that Petspeed is now available on the Commodore 64 is all this item has to say.

To the rest of the world, all one needs to add is that Petspeed compiles Basic programs into faster code which can run anything from twice as fast to 40 times as fast as the original code.

Details from Oxford Computer Systems on Woodstock (0993) 812700.




*The pattern laid out on the top of this cigarette-box size package is a sort of circuit layout, showing what the box can do for a Sinclair ZX Spectrum. Round the edge are colour-coded sockets into which wires can be wedged. They can be input analogue signals, output relay lines, switch input and output, and two I/O ports.*

*In other words, the DCP Interspec connects the Spectrum to other electronic equipment from automatic washing machines to pianolas. Details on Norwich (0603) 712482.*

## No sex, please

Possibly the idea of a program which plays selections of Robert Carrier's menu recommendations on a VIC 20 is a silly idea, but I don't see why former *PCW* publisher Felix Dennis had to get quite so hysterical about it.

A less silly idea, I think, is Ivan Berg's latest program for the machine: a transcription of the tests in Hans Eysenck's book *Know Your Own Personality.*

The machine asks all Eysenck's questions, and then plots the personality rating on three ways of reading personality.

Unfortunately, Berg has left out the two really interesting aspects of personality — social/political attitudes, and sexual attitudes.

'We didn't want it to be too long, and wanted to leave something out,' he said. 'Anyway, the sexual one was very explicit, asking questions about orgasms, and so on.'

I think it would make a *great* party piece, and I hope he brings out part two very soon.

He also does 'Know Your Own IQ' which may not tell you much about your brain, but will certainly make you good at doing IQ tests, if you're thinking of joining Clive in Mensa.

## Micro mania

Help is coming to muscular dystrophy sufferers from Tandy in the form of a national games competition to raise money for research into possible cures for the disease. Every Tandy store has been equipped with a TRS-80 Color running Tandy video pinball games and members of the public can pop into the store, pay 50p and attempt to reach the highest score in their region. All winners will receive a TRS-80 Color Computer as their prize and are invited to a national play-off at the *Which Computer?* Show on 18 January next year. The national winner will be presented with two disk drives and an extended software and memory pack, giving a prize worth over £1000.

Anyone (except, presumably, Tandy's employees) is entitled to have as many tries as they like at the game — the more the merrier, in fact, and all money raised will be donated to the Muscular Dystrophy Group. In addition there'll be well-known personalities promoting the venture throughout the country.

The first games were played at a press launch on 19 October and the competition will close on 8 December. Tandy is the first micro manufacturer to organise any kind of charity-based promotion and the competition is a first for the Muscular Dystrophy Group.

## Accounting for taste

Quote: 'Although business software for microcomputers has been available for some time' (true) 'Padmede Computer Services has now developed a new system, which is designed to provide faster operation, more flexibility, and greater integration.'

Padmede said that. The software is accounting software, and the word

'integration' is a magic word when it comes to accounting software.

It runs on CP/M or MS-DOS operating systems.

Apart from that, all you can say is that it is available, and try to find out from a user what it is like, because there is no way of describing it in print. Details on Fleet (02514) 21892.

Quite separately, Mediatech has also announced a range of accounting programs called Accounting Plus, which were originally supplied on the Eagle Computer range.

'It is probably the most comprehensive CP/M accounts package available on the UK marketplace,' says Mediatech, adding that modules cost £400 each except for the £600 payroll module.

Again, not much point in adding anything to their claims except the phone number: 01-903 4372.

## Apple walker

The baby, the Apple and the teddy bear are all trying to make sure that the baby will be able to walk.

Apparently a few of us (human beings, not teddy bears) are born with dislocated hips. Normally, the only way to tell is to wait until we can't walk a couple of years later, and then wish we'd detected it at the time, because now you're stuck with painful operations, and not much chance of ever getting a normal hip.

The way to tell that you have dislocated hip joints is to listen. Unfortunately, doctors aren't very good at detecting the difference between the sounds made by a normal baby's hip and a dislocated hip.

Apples, however, can do the job.

The one in the photo is at the Musgrave Park Hospital in Ireland, and is produced with extra hardware and software to listen to joints clicking, by Medical and Scientific Computer Services Ltd of Lisburn, County Antrim.

According to Robin Jelly, managing director of the company, the software took a few tries to get right.

'Data comes from the transducers attached to the baby, every 100 microseconds,' he says, 'and is analysed by a complex machine code inside the 48 Kbyte Apple.

'The trouble was that originally the machine code program took 130 microseconds to run. It had to be "tuned" to get it faster. It now runs in 96 microseconds.'

After clinical trials, the equipment will be marketed around the world. Anybody interested should phone (08462) 77533, or write to the company at Altona Road, Lisburn, Co Antrim, N Ireland.

You don't get a free teddy bear, however.

## Spreading the word

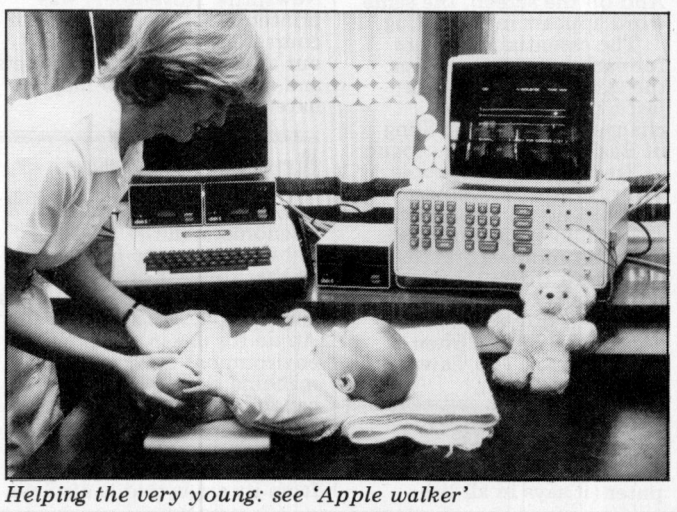
To the many people who use CP/M machines because they have to (because the software they want to use runs on a CP/M machine) it will seem strange that there are people who use it because they think it is wonderful.

Like all cranky religious sects, these people don't take criticism of their God kindly, and look forward to the spread of his Gospel into the next generation of machines.

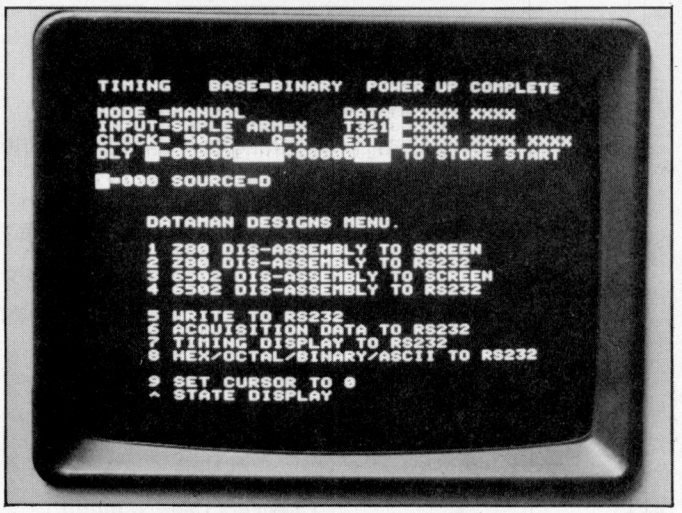
These people will be delighted to hear that Euromicro, a company which makes fairly expensive systems based on the old S100 standard circuit boards, has moved not only CP/M but its multi-user brother, MP/M, into the world of 16-bit processors.

It has produced a processor board which fits into the S100 box, and has two micro chips on it — the Intel 8085, and the 8086 — the 8086 being the full 16-bit chip of which IBM and Sirius use the chopped-down 8088 version.

This system starts at a mere £4000 for a single-user version with disks and display, so it clearly isn't the price which makes it interesting.



*Helping the very young: see 'Apple walker'*




*Logic analysers made by Thandar enable computer designers to check out new microsystems; one of the customers who used the Thandar 2080 now reckons to have improved its design.*

*'It had disadvantages,' according to Dataman Designs. 'The output was solely to the screen, not to the printer, so only a small part of the data could be seen.' Also, no disassembler was available to turn the raw octal, hex or binary code into sense.*

*The system works with either Z80 or 6502 chips. Cost is around £2000. The photograph shows the new menu to control all the new features. Anybody who is not a computer designer, ignore it. Otherwise, contact Dataman on (0300) 20700.*

What makes it interesting is a combination of things: first, the fact that (like the Digital Equipment Rainbow) it has both 8-bit and 16-bit processors together, and can tell which processor to apply to which task; and secondly, that it can actually run 8 and 16-bit programs simultaneously.

The software which makes this possible is a new version of Digital Research's CP/M family, MP/M-86.

There are those (and I agree with them) who say that putting multi-user software on a cheap micro is a silly idea. If you would like the argument in full, read Brain Dump; for now, it is enough to say that it is usually cleverer to get two cheap micros than to buy one expensive one and connect it to two display terminals for two users.

Despite the fact that it is a silly idea, it will continue as long as the minicomputer makers ask £20,000 for the smallest multi-user system they make, and make the smallest system less powerful than the average micro.

It the recent past, the idea was even sillier, because MP/M was needed to do it, and MP/M could not be trusted.

On this system, however, you don't get MP/M, but its 16-bit relative, MP/M-86.

Euromicro's boss, Jim Wood, says that yes, he accepts that MP/M used to have its flaws, but no, MP/M-86 is a new product, reliable and to be trusted. Wood is actually a very honest man so, at the very least, we can accept that if there do turn out to be flaws in the software, they are flaws he could not have known about.

The only thing that rather puzzles me is the use of the Intel 8085 chip, rather than the Zilog Z80, as the 8-bit processor.

To be sure, the 8085 chip can run a good deal of CP/M software — but if you are paying this sort of money for a 16-bit system, then surely the only reason for throwing in the 8-bit half is to make sure that the customer can keep any and all of his old CP/M programs. And while the Zilog chip can run most software that the 8085 can run, the opposite is less true, and the Zilog is, today, the better bet.

Euromicro is on 01-341 2447, and past fans will recognise that number as one which used to belong to Ithaca Intersystems. It is the same company, but Olivetti bought the US parent, and the name — they had to change the European name as a result.

## Blowing up a storm

Anybody who has written a Basic program longer than 20 lines will have found, one day, that there are two instructions to GOTO 200, and they can't remember where the other one is, or that there are three GOSUB 3000s and one of them is line 450, but what of the other two?

On the Apple these people can now do a simple search for a string, using new soft-

ware called Gale, from MicroSparc.

Gale 'gives Applesoft programmers the ability to perform global searches and replacement of any specified character or characters throughout a program,' says the supplier in Lincoln, Massachusetts. 'Line by line editing allows you to make fast changes without recopying an entire line — you can delete characters, insert characters, compact a line by replacing PRINT statements with the equivalent (a question mark), enter lower case characters, and so on.'

Details on PO Box 325, Lincoln, Mass 01773, or try phoning (617) 259 9710.

## Three card tricks

In the nicest possible way, the Director of Fair Trading has warned micro suppliers that a lot of their products look like a three-card trick to the public.

Marvels such as automatic checkout machines, automated shopping and banking, and viewdata catalogues, he says 'have potential benefits to offer'.

But: 'I put forward with some force a caution to the innovators that the new electronic marvels may fail to gain public acceptance' — a nice way of phrasing it — 'unless the shopper can plainly see that his or her interests have been safeguarded, and that the benefits do not accrue solely to the shopkeeper and the bank.'

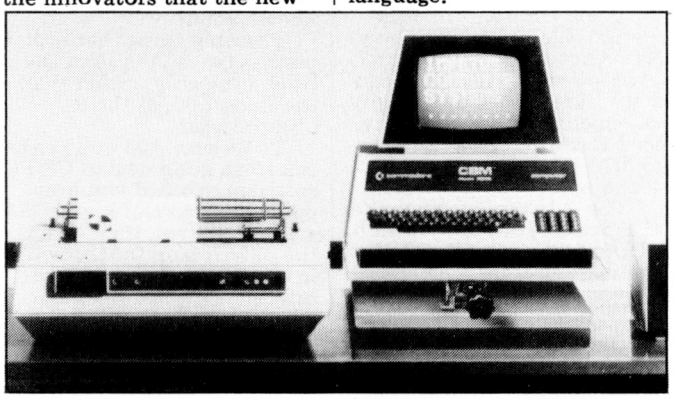
The Director, Sir Gordon Borrie, offers this advice on what 'user friendliness' really means (not just chummy chat on the screen) in an OFT report on the effects of microelectronics on 'the consumer' — you and me.

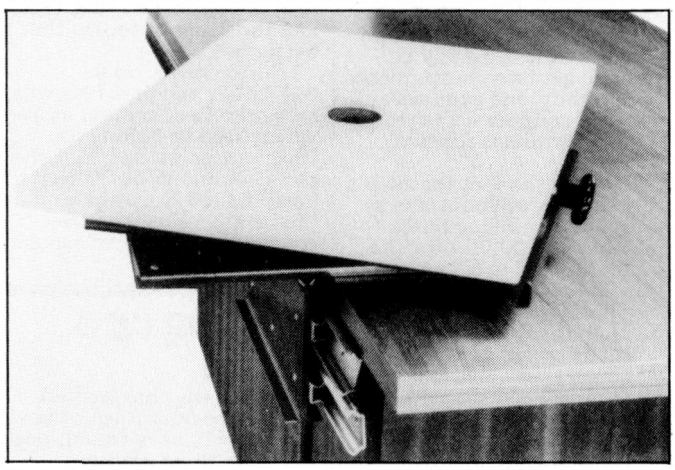
The report, 'Microelectronics and Fair Trading', is available from the Distribution Unit, OFT, Room 600, Chancery House, Chancery Lane, London WC2A 1SP.

## And nation shall speak unto nation...

Chinese micro users now have a machine which they can program in Basic — which, as the listing here shows, is quite a problem.

The word PRINT makes a lot of sense to English speakers, so it is quite sensible to use it in a programming language.

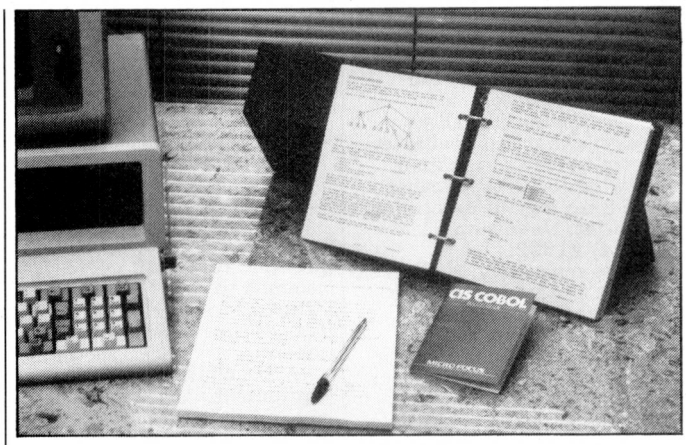




*Swivel stands for desks aren't the sort of chip technology you pay to read about in this paper, but for people who have a machine which covers more than half the desk, they may be more important than semiconductor details.*

*These swivel stands are by Chasmood: they fasten to your desk, and let you slide the computer back and forward, as well as swivel it about.*

*Chasmood is on (0483) 577161, and they make no guarantees about the stability of your own desk with one of these fastened to the side.*




For the Chinese, however, it is daft. Ask the average Streatham computer club member to use the ideogram showing two waffles on top of a barbeque next to a three legged table with a minus sign floating over it, and it is possible that he would regard Basic as a daft language, too.

```
>條列

20 方陣A(20)
30 註解 ASSIGN A(I)
40 從I = 1至20
50 A(I) = 5 * I + 2
60 下個I
70 註解 PRINT A(I)
80 從I = 1至20
90 顯示A(I)
100 下個I
```

The solution has been produced by a Taiwanese company called Multitech, which rather thinks it has an idea with world sales potential — because while a lot of people can write English, most prefer to write something else.

The Multitech micro, like Sinclair ZX machines, uses a single key to tell the computer to perform some Basic function.

But on the key, instead of PRINT, you get two waffles (etc, etc). Or in Italy, the appropriate Italian word. And on the screen, the same word appears in the listing.

The essential hardware for each language remains the same, says Multitech; just a plug-in cartridge changes the native spelling of Basic into the local togue.

Presumably few people will rush for the Chinese one, but nonetheless, details are available: the address is just a bit more exotic than the run of the mill ones usually printed here. It is Multitech Industrial Corporation, 977 Min Shen E Road, Taipei, 105 Taiwan, ROC.

## Soft Sirius

The Sirius is a lovely computer (it says in all the reviews) because you, the user can change the shape of the letters on the screen. The screen is, they say, 'soft'.

Hands up all users who know how to do it, then?

All the rest of you will want Kuma's new character set editor, obviously. Details on Maidenhead (0628) 71778.

## Making space

Programmers who earn their living at programming still include a large number of Cobol writers, who will now be able to buy an even better version of their favourite language for micros.

Micro Focus, the designer of CIS Cobol, has now released a new version which 'makes more user space available'.

The operating software which stays in the machine when it is running compiled CIS Cobol code is smaller, in other words.

It has also put new ribbons on: smaller and lighter manuals. The manuals, says the company, 'stand up independently when in use' which I *think* actually means they don't fall over (see picture) because they are supported from behind.

Worth every penny of £425. Details on 01 722 8843.

## Apology

For some obscure reason, the price of the Oric 1 (page 85, Newsprint November) was printed as £499. It should, of course, have been £99.95 — our apologies to Oric Products and any readers who may have been misled.

## Apple revamp

One of the most common phenomena in the micro industry seems to be the use of the Apple II as a base for all sorts of interesting add-ons and upgrades either to fit the Apple for use in a specialised environment or to give the machine state-of-the-art capabilities.

Perhaps the reason for the common use of the Apple as opposed to other machines from its era is that it displays

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**1** The heart of this office of the future is the powerful new Osborne 1 portable computer, with 64k memory, two disc drives and a built-in monitor. The Osborne is linked to an Olivetti Praxis 30 11cps daisy-wheel printer/typewriter for printing your work superbly. In addition you get a packet of software (sold elsewhere for up to £800) to make your office of the future into a word-processor or a financial planner.

**2** Your Osborne and Praxis are a remarkable combination. The machines are so portable you can carry them both home instead of working late. Plug them together slip the Wordstar/Mailmerge disc into the drive and you have a word-processor as good as costly dedicated systems. Change discs for Supercalc and you have the power of a dozen clerks for your budgets. Then Osborne types your work perfectly on Praxis.

**3** The Olivetti Praxis 30 is a new style electronic typewriter with its own memory, automatic erase, and a double keyboard which gives you 14 extra characters. Use your Praxis on its own as a prestige easy-to-use typewriter, or plug it into your Osborne and use it as a high quality computer printer.

O-COMPUTERS
A member of the C/WP Group
104-106 Rochester Row, London SW1
Telephone: 01-630 7575



*This is the Philips Prospect, which Philips describes as a 'budget price start for word processing.'*

*It isn't a microcomputer, and Philips didn't say what the 'budget price' was. Not encouraging. However, Philips does add that the word processing side has been enhanced, because the system is 'equipped to perform the complex number of infomation management procedures traditionally associated with the Philips P5000 Series'.*

*Explain what 'tradition' actually means to someone on 01-636 6561, where you will find the publicity agent who handles business.*

both simplicity and versatility. Equally likely as a reason is that many companies (and homes) bought the Apple when it was new and now want the capability of a modern computer without having to shell out for it. The Robocom Bit Stik is one example of this phenomenon.

To add to the legion of gizmos and widgets which stick on the end of an Apple come the XAD1 industrial control card from Xcalibur Computers of Northampton and the Apple with a special power supply from MC Computers of Newbury.

The XAD1 will permit the Apple to be used for measuring analogue or digital signals by providing four channels of 12-bit integrating A/D conversion. It provides a battery packed clock/calendar, contact energisation voltages on board and screw down terminations. There's also the four channels of isolated reed relay contact outputs to add to this list of extras. This card is, of course, designed for the scientific or industrial user as a controller. The real time clock ensures that any measurements are carried out at regular intervals.

This card costs less than £100 (we are not told how much less) and is provided with full documentation providing operation examples. Details from Xcalibur on 0604 21051.

MC Computers' special power supply Apple is a standard machine with a PSU built in which offers the ability to power the Apple from either AC or DC supplies. If both are connected the DC unit is trickled charged from the power supply. If the AC source fails then the PSU switches to the DC source without interrupting the system at all. Power outputs are short circuit protected.

This special PSU is also being offered as an option within MC's butch repackaged Apple II for industrial use. MC Computers can be reached on 0635 44967.

*Maggie Burton*

## Adventurous games

Influenced, probably, by Kit Williams' Masquerade quest for the golden hare comes a new trend in computer gaming. This is the idea of an adventure game with an ultimate solution leading to a big prize for the first person to crack it. Probably the best known one will by now be Pimania from Automata Cartography. The prize here is the Golden Sundial of Pi — a sculpture in gold and diamonds valued at £6000. Players have to find out where in time and space the sundial is hidden by travelling through a series of gates of Pi and following clues which are very often difficult to find — concealed in music and mixed up with red herrings, for instance. Now Artic Computing has jumped on this new bandwagon with a game called Krakit which carries a prize of at least £10,000 for the first person to solve 12 clues. Pimania will be launched by the time you read this — mid October — and Krakit will be launched on 1 November. Both games will run on the Spectrum and Krakit works on the ZX81 as well. Details of prices and availability will be advertised shortly.

Artic has also produced a speaking chess game for the Spectrum. This is based on the company's original Chess game, ZXChess which is well known for its strong play. Voice Chess tells you its move, repeats yours and makes sarcastic and ambiguous comments on the state of play. It costs £9.95 and runs on the 48k machine.

*Maggie Burton*

## 4MHz Sharp

If you'd like your MZ-80K to save and load programs twice as fast, run large programs at a much greater speed and still offer the choice between 2 and 4MHz processing speeds then John Bosco or Steve Oates should have the answer. At £45 their 4MHz board will offer all the above without affecting the MZ-80K's clock or sound. It comes with a red/green LED and switch to indicate which of the two speeds the machine is running at.

Details from John Bosco or Steve Oates on Leeds 520938 or Wakefield 279348. Incidentally, a version is also under development for the MZ-80A.

*Maggie Burton*

## Pro Digital

Prospero Software recently announced its decision to make the Pro Pascal compiler available on the DEC range of personal computers, including the Rainbow. An agreement to this effect has recently been signed which will run initially for five years giving DEC worldwide marketing rights for Pro Pascal on its own computers. Pro Pascal will be included in DEC's classified software directory.

*Maggie Burton*

## Festival fun

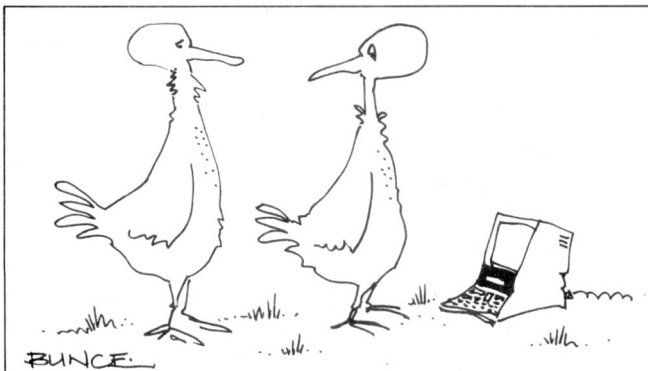
Here in the bustling capital the GLC has branched out the tentacles of its efforts to promote cultural activity with a computer festival. This is because London is becoming increasingly aware of the micro revolution following the success of such ventures as those organised to mark IT year, the ALCC's annual computer fair and the growing number of computer shops, advice centres, clubs and workshops. The festival will run from 3—17 April next year and is London's first.

The festival will promote and publicise the activities of all relevant organisations offering help 'within the community'. It aims to spread knowledge and awareness of how information technology is used in everyday life and help people get in touch with organisations offering courses, advice and the like.

It will also provide some special events. One of these will be an exhibition from 14—16 April at the Central Hall, Westminster which will include the London Computer Fair. The Festival is being organised by a consortium of the ALCC, the National Computing Centre, City Tech, the North London Poly Computer Centre, ILEA's Computer Centre, the GLC and several London Boroughs.

Anyone who would like to run an event as a part of the festival, be included in its diary of events and promotion or who just wants to know more should contact the Secretary to the Consortium, GLC Central Computer Service, Room 431, County Hall, London SE1 or telephone 01-633 3348.

*Maggie Burton*




*'Good God! You don't still migrate by instinct, do you?!!'*

# C/WP HAS ITS WAY WITH THE DAISIES

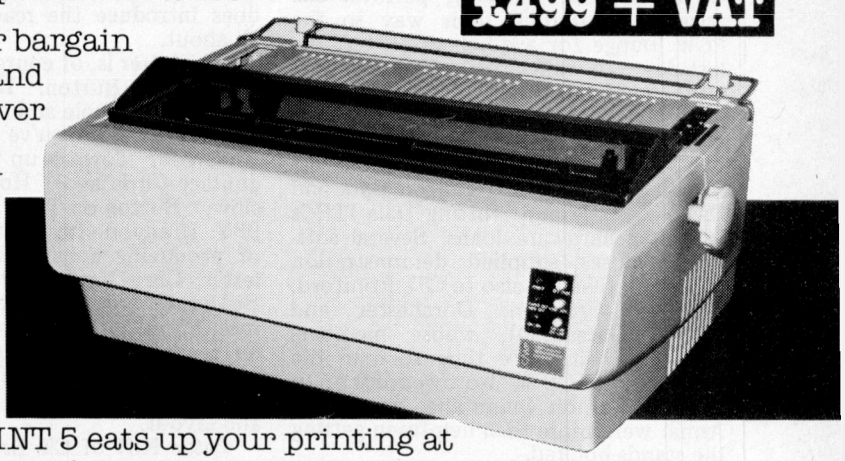
**£399 + VAT**



If you want good quality print, clean and crisp as a lettuce leaf, you need a daisy wheel printer. But you pay for that quality. Or at least you did, until C/WP, which shrunk Apple prices (yes, still £499 + VAT while stocks last), had its way with the daisies. Now, thanks to C/WP you can afford the smartest print in town.

OLIVETTI PRAXIS 30, baby of our range, not only prints superbly from your computer, but doubles as a portable electric typewriter with automatic erase ribbon and 10 character memory. It's slow (11 character a second or around 5 minutes for an A4 page), but what quality. And what a price – only £399 + VAT. Others advertise the same printer for £480 + VAT.

**£499 + VAT**



The TEC STARWRITER is an even bigger bargain at just £499 + VAT. It prints bidirectionally and impeccably at 25 characters a second (just over 2 minutes a page) and responds to all the commands Wordstar throws its way. A really professional, heavy duty, thoroughly reliable daisy wheel, which has never been sold at such a low price.

For those who are only satisfied with the best, C/WP offer the QUME SPRINT 5 – the industry standard, normally sold for £1800 or more – for only £1295 + VAT. SPRINT 5 eats up your printing at 45 characters a second (about 75 seconds a page) with unbeatable quality, no fuss and not too ghastly a noise. Or if you prefer a printer with a keyboard, to use as a typewriter when you want, you can have a QUME SPRINT 9/35 KSR (35 cps) for the same low price, £1045 + VAT.

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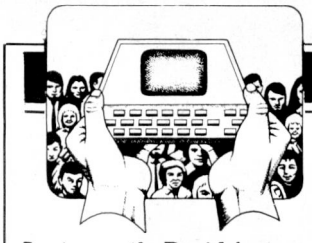



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# CTUK!NEWS

*Maggie Burton chats about the PCW Show and all the latest news*

Last month David just managed to slot in a brief mention of what CTUK! managed to do at the *PCW* Show. Well, thanks to John Bone, I've got quite a bit more to tell you this month. There were two ComputerTown stands this year (an increase of 100 percent on last year) and both were packed throughout the Show — one volunteer said it seemed as if every visitor to the Barbican had dropped by the stands.

Over 8000 leaflets were given out by those intrepid lads and lasses in a big effort to explain what CTUK! is and why it's still getting bigger. Two new 'Towns were promised by visitors to the stands and members of the public had some trouble working out what was actually being sold — a few did not believe that the use of the micros and all that advice was *really* free.

Many youngsters dragged their parents onto the stand to be 'talked around'. John tells me he was unable to beat the Scrabble micros (but so was I) and the signposting in the halls was found to be rather lacking — a few CTUKites did, however, perform the miracle of finding their way to the *PCW* lounge for a quick drink on the last day — a well-earned one judging by all the hard work that was done.

Some 15 micros were up and running on the stands and I've been asked to add to David's vote of thanks from last month by mentioning Dragon Data and the Newcastle and Notting Dale ITECs for their hardware loans. Several software houses supplied demonstration programs. Thanks also to CTs Romford, Ashford, Croydon, Dorchester and CTNE! (Gateshead), whose members gave up their spare time to man the stands. The ACC is also owed our gratitude as Vernon Quaintance and David Annal were more than helpful in getting the stands booked.

Lastly, but not leastly, for those living in the Thames TV area, the stands were filmed for a short computer series starting in November — watch out for it!

Now onto rather less festive news. Kent County Library has agreed to make space available in all its libraries where possible for CTUK!. Incidentally, you only really need about 12 square feet of floor space to run a small 'Town, so many of them will not be putting too great a demand on Kent's library space.

While still on the subject of libraries, Burton-on-Trent library has, it seems, decided not to allow CT Burton to use the library for nothing. This seems a shame as so much goodwill goes into running a 'Town and it would be nice to think this particular library committee could follow Kent's generous example. The reason for this is, apparently, that granting free use of library facilities would 'set a precedent among other clubs and societies'. What seems to have gone unheeded is that ComputerTown does not request any fees from those who attend, nor does it have any members as such — apart from those who run the 'Towns, whereas the trend among 'other clubs and societies' is to charge subscriptions or attendance fees.

Chris Woodford of CT Burton is, in spite of the hassle, running a thriving 'Town. He's just started to produce a newsletter in his spare time and other ComputerTown organisers might like to consider this idea. However, there are one or two problems with this. There may be times when one person cannot produce a newsletter alone, for various reasons, and if only one 'Town is producing it money can become a bit of a problem. A syndicate of two, three or four 'Towns could produce a nicely put together newsletter for very little outlay and if it's readable to the absolute beginner it will draw a good response. Copies could be left at libraries or leisure centres or just given out to passers-by in the street. Burton's newsletter is packed with news on micro developments and ComputerTown activities and short articles related to micros — indeed, when you look at the amount crammed into a mere two pages, you wonder if they couldn't perhaps teach *PCW* a lesson or two on production economy! The letter also includes a quick glossary of all the jargon used within it which, although it's very brief, does introduce the reader to what it's all about.

The letter is, of course, not only applicable to Burton. It's relevant to CTUK! as a whole and contributions are invited for it. If you've got any news on what your 'Town is up to, then you can contact Chris at 31 Hopley Road, Anslow, Burton-on-Trent, Staffs DE13 9PY. If anyone has thought of the idea of producing a national CTUK! newsletter, Chris has thought of it already. He hasn't got the time to do it every month, and if he's to get it going he needs help from one or two others. David and myself would be happy to help in any way we can with production and layout.

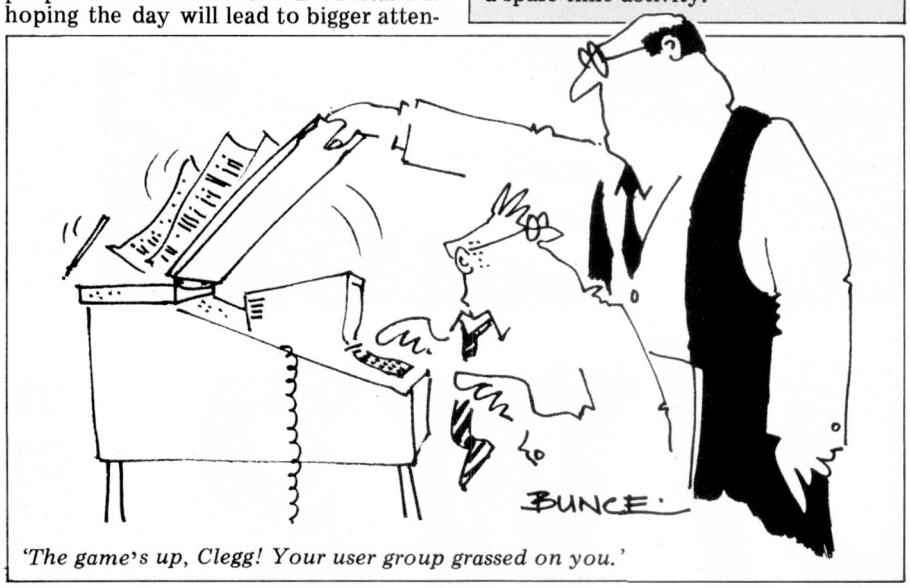
Peter Kiff of CT Broadstairs held a special 'education day' on Saturday 10 October in Broadstairs Library for teachers and parents to come along and see how computers can be used in the classroom. This was very popular and fulfilled its purpose of attracting new people to the 'Town. CT Broadstairs is hoping the day will lead to bigger attendance at future ComputerTown meetings. Displays included one of books, and there was a TV screen in the foyer to welcome visitors and tell them where to go. ZX81s, RML 380Zs, a BBC and a PET ran education-oriented software all day.

There have been several successful ComputerDays over the past two years and we'd like to hear about them all in future — in advance and afterwards. Next month we'll have a few ideas on ComputerDays to put forward. Watch this space!

The Prestel index of ComputerTowns has now been moved to another page. The number quoted in the October issue was a temporary page and the new location is page *800803#. Vernon Quaintance of the ACC is the man to contact if you find your 'Town is missing from the index. And a complete list of ComputerTowns will soon be on Rewtel — dial up and take a look if you've a modem or an acoustic coupler. The number is 0277 230959 from 6pm to 9am weekdays and all weekend.

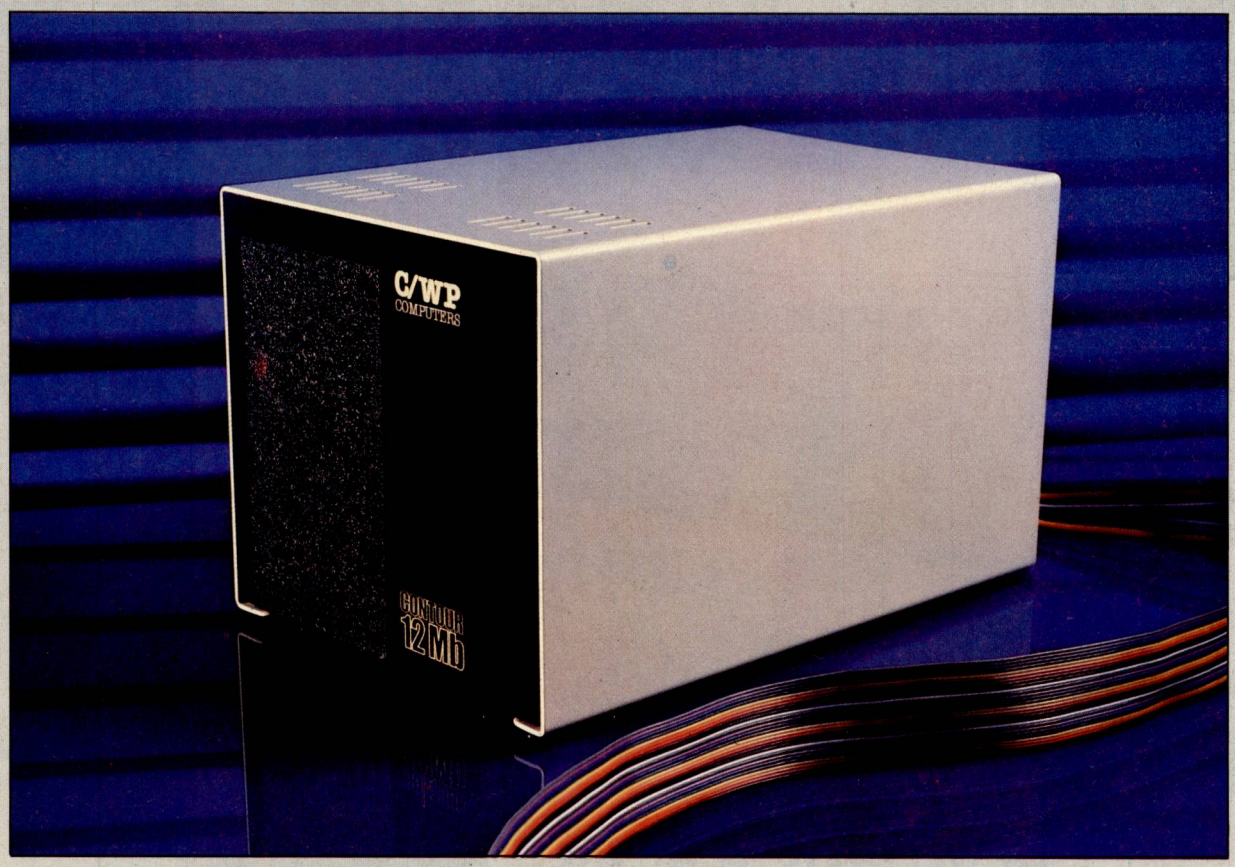
To finish off, I'd like to send our warmest congratulations to Frank Fadipe — the ComputerWeek stalwart — on the birth of his son. We hope he'll grow up happy and healthy and have a bright future.

**Computer Town UK! is an ever-growing network of computer literacy centres where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. Computer Towns might be found anywhere — in a church hall, a library or perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because Computer Town is entirely non-commercial, any kind of axe-available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcoke, Middlesex HA4 9EL or 17 St George's Road, London NW11 0LU. Remember to enclose an A4 SAE for your reply. Please don't telephone *PCW* for information as CTUK! is entirely a spare-time activity.**




*'The game's up, Clegg! Your user group grassed on you.'*

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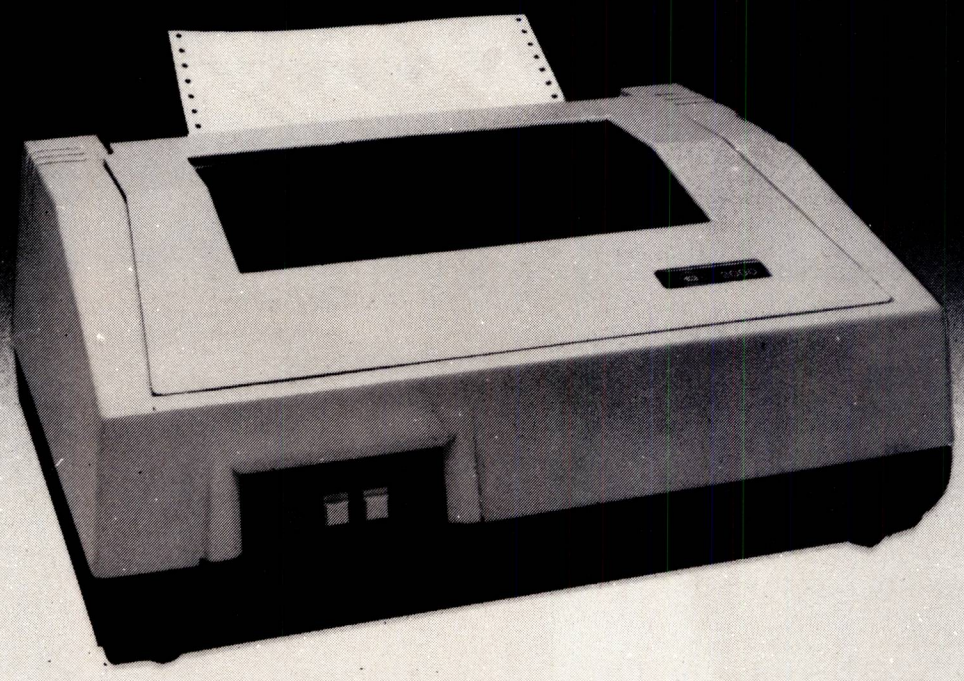
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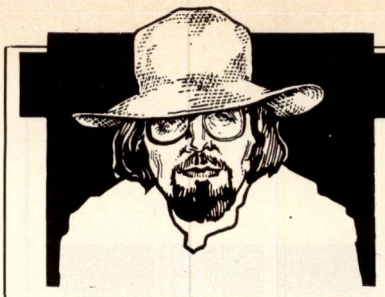
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# BANKS' STATEMENT

*Martin Banks provides more punditry on chips and things*

# CHIPPERY AND RIVALRY

It is some time since I last wrote in any seriousness about chippery and things in this august magazine *(Late again, Banks: this is the December issue — Ed)*, though it is a subject that is quite dear to my heart. So this month, given that something of interest has occurred in the semiconductor business, I am going to have a go.

In fact, I have in mind two distinct and separate subjects for this month and their only connection is the semiconductor industry, so I'm going to try to stick them together, with only a half-hearted attempt at finding a more cogent link between them.

The first is to do with marketing, and the application of the marketing ploys learned in the semiconductor industry to the personal computer business. The second is to do with the application of the technology of memories, in the form of firmware. No, this is not something that might prove of interest to Mary Whitehouse, but it is to do with the storage of software in hardware form, which to the gizmo-freak means ROMs, PROMs, and EPROMs.

The economies of semiconductor manufacture are those of many high technology, high capital cost products — it costs as much to produce one chip as it does a million of them. As there is more chance of selling a million — because a lower unit cost can be charged — than there is of selling one *very* expensive chip (the high price being to cover the high capital costs) then the semiconductor industry duly makes millions of them.

The drawback of this is that the chips themselves have to be of a type that users want to buy by the million, so, except in occasional circumstances, there is little profit in the semiconductor companies producing anything too far out of the ordinary.

Indeed, it is a general rule that uniqueness in chip design or manufacture is akin to the kiss of death, No self-respecting systems manufacturer is going to commit a new design to the production line when that product employs a type of chip that comes from just one manufacturer. Should that supplier go delinquent, which is a delightful American way of saying screw up on the supply of chips, then the whole production run, and the investment involved, can go down the Swanee.

So chip customers seek second sources, an alternate source of supply for the same part. The semiconductor companies now go to great lengths to ensure that such second sources are available to the customer, usually by licensing their 'rivals'.

Such 'second sourcing' has now come to the personal computer business, and it has come to Europe, not America. The particular deal in question specifically precludes our American friends from taking adantage, as will be revealed.

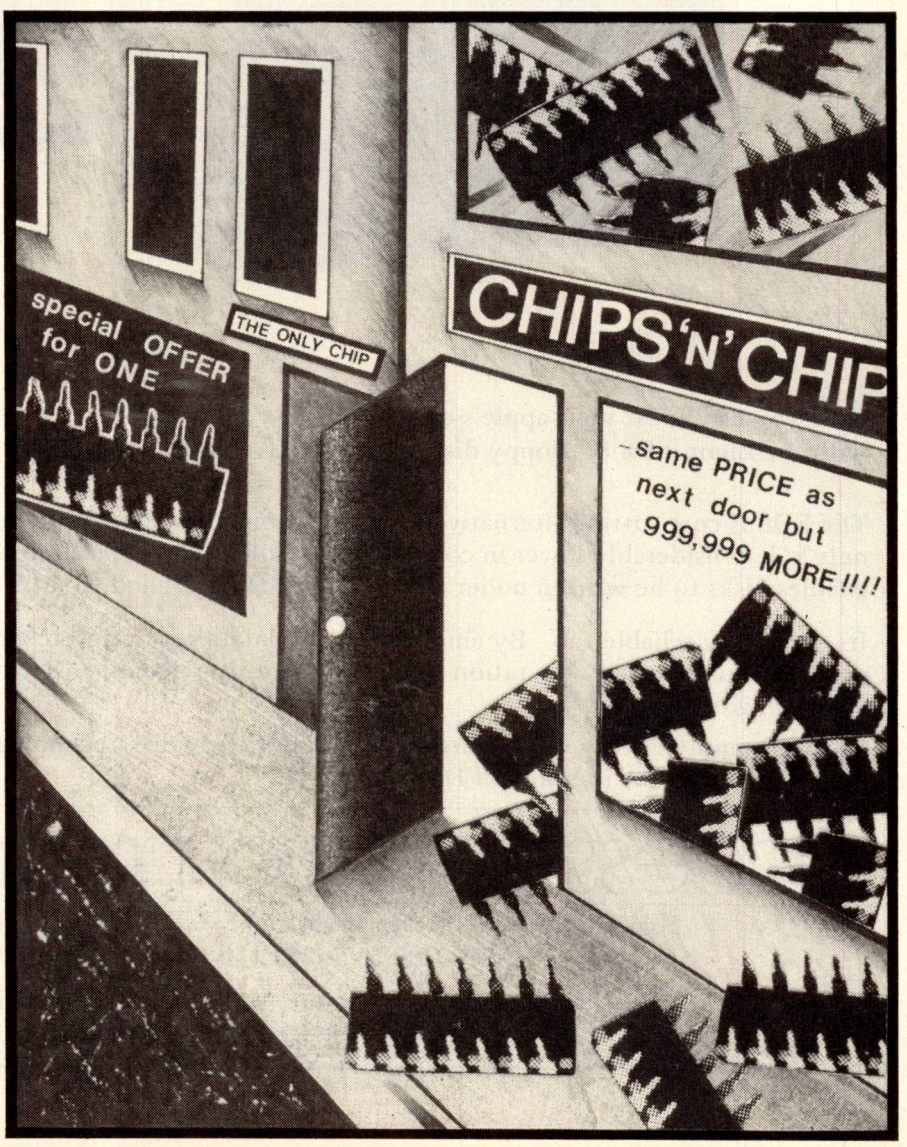
At the beginning of this year, the observant among you would have noticed the arrival of the Sirius 1 system from the drawing board of one Chuck Peddle, father of both the PET and the 6502 microprocessor. The Sirius company was funded in its efforts to develop the machine by a deal in the USA with Victor Business Machines. By way of recompense, Victor took the rights to the US market for the machine, which is manufactured for them by Sirius. Both companies are allowed to sell into the other markets around the world.

Victor declined to call their version of the machine the Sirius. Instead, they called it the Victor 9000. Well, you might ask, what's in a name? — and for European customer that would indeed be true, because the customers are getting real and legal second sourcing.

Yes, the recent introduction into this country of the Victor 9000 means that the customer has the opportunity of making a choice in the purchase of a system. And, if it happens to be the Sirius/Victor system being considered, to go out and shop from alternative sources.

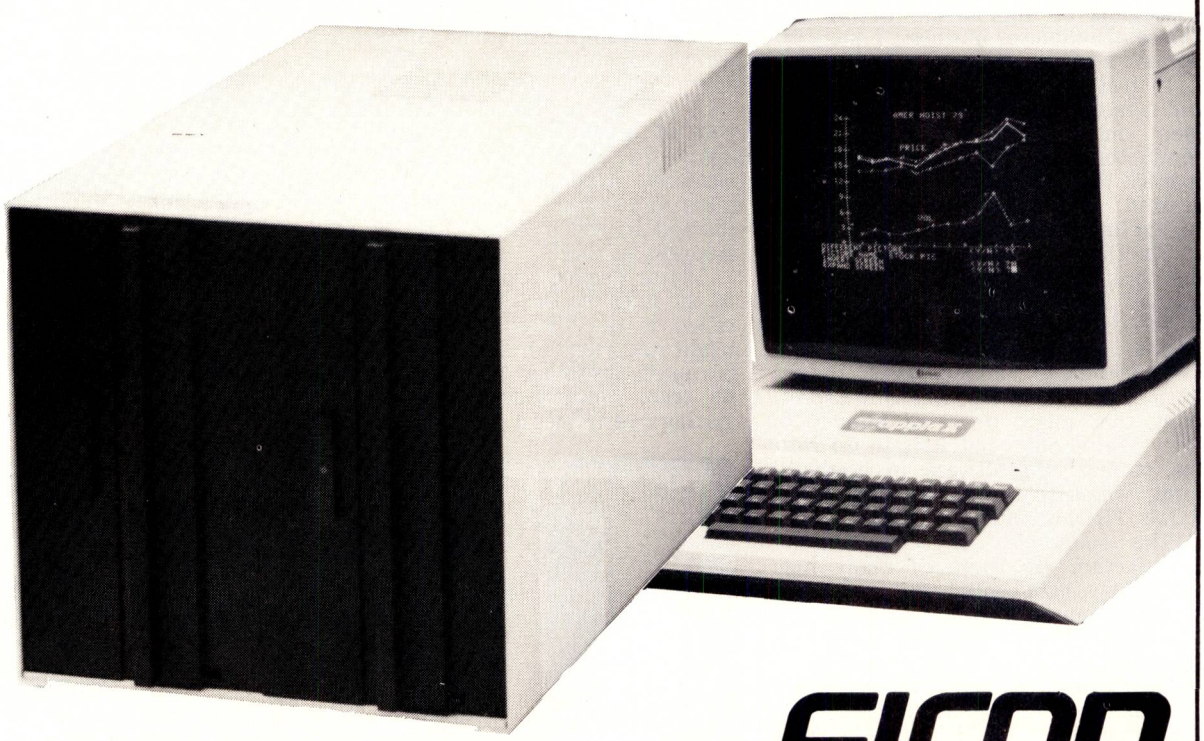
From the user's point of view this can only be a good thing, for it will give greater scope to these all-important subsidiaries — things like service, support, and specialist knowledge, as well as price and delivery — that all dealers should find it important to offer. If a dealer in one type of system seems poor, the chances are there will be a dealer in the other system not too far away.

This could, of course cause a problem for the dealers themselves, and even for the two importing companies: ACT for the Sirius, and DRG for the Victor. The latter is hoping to have 100 dealers




Dear Mr Tommervik

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# BANKS' STATEMENT

around the country and, according to them, some 60 percent of the dealers that have made an approach are existing Sirius dealers.

DRG has said that it has a working understanding with ACT, especially on such items as pricing, and is not against appointing dealers that already handle the ACT import. It will be interesting to see whether this understanding stands the test of business practice.

Having two sources for the same machine (the only differences are a slightly different keyboard and a resprayed box), especially when that machine looks like being extremely popular, can only be good for the customer.

And what is good for the customer forms the extremely tenuous link to the second theme for the month, which is all to do with firmware. Now this is the trick of loading commonly used software into a hardware form such as ROM or PROM. It is an idea that has both advantages and disadvantages, though its long-term potential as an aide to systems design, systems configuration, and user choice is considerable.

The reason I mention it this month is because of an announcement by Intel, the company that brought you the 8080 and the 8086 processors. As its 8088/8086 family looks like being the biggie in the 16-bit systems stakes, it being at the heart of the Sirius/Victor and the IBM PC among other machines, it is sensible for the company to look for other related areas where it can turn an honest dollar.

Now, as already mentioned, the real application of the firmware idea is with commonly used software. This is because of the nature of semiconductor manufacturing, where volume production is king. Only with software that is fully debugged and in great demand does firmware really make sense.

In the 16-bit marketplace, such a target for firmware is an operating system, and it is one of these that Intel has selected. The one it has gone for is CP/M-86 from Digital Research, for which Intel has just taken out a licence.

It is now in the throes of finalising a new chip that will incorporate the operating system in silicon. To be called the 80150, the chip is intended for use with the 8086, 8088 and the latest Intel processor offering, the 80186.

The chip will contain Version 1.1 of CP/M-86, held in 16 kbytes of ROM, which will be accompanied on the chip by some important hardware functions needed by the operating system, such as timers and an interrupt controller.

The obvious market for such a chip is in the vast army of stand-alone systems currently being produced by the likes of Sirius/Victor and IBM. It makes a great deal of sense from everyone's point of view, for by having not only the operating system, but also some of the attendant chippery required for it, resident on a single chip, systems manufacturing costs will be brought down. It will also make the design of any new systems based on the Intel family that much easier, and therefore cheaper(?). Not surprisingly, it will lock systems manufacturers even more tightly into the grip of Intel (and almost certainly its official second source suppliers), which will no doubt please the company.

For the user, this should mean not only cheaper systems. It should also give (in theory at least) more reliable systems, as the chip should be relatively bug-free, and certainly free from being corrupted as it might be in disk form. It also makes a system more user-friendly as the O/S becomes an integral part of the hardware, with the booting-up procedure totally transparent to the user.

It is also one more step along the road to the appearance of more general software in a firmware form. This could well include some complete applications packages that are popular and 'standardised', such as the 'Calc' programs and the word processing packages. Games packages will be (damn it, *are* ) another target market for firmware. Other applications areas, for example accounting, may well be too complex and variable for such overall treatment, though it is likely that 'tailored' programs may be constructed out of ranges of utility packages and sub-routines that can be linked together.

System configuration could then become easy. The user could actually do it himself. . . perhaps. A system would be a processor, memory, and spare sockets into which the user popped whatever ROMs held the software needed. The ROM'ed O/S would do the rest.

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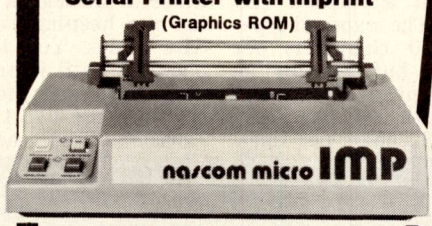
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# BRIT PRINTER TAKES ON THE JAPS

*Peter Rodwell tests a new British low-cost dot matrix printer aimed at a market currently dominated by the Japanese*

When the micro scene first began to take off, one company dominated the small, low-cost dot matrix printer market — Centronics. In the last two years, this enviable position has been usurped by the Japanese; specifically Epson, whose printers are found not only with Epson labels on them but in a wide range of colours and cases with other people's tags stuck on.

Now a British company called Walters Microsystems has tackled Epson head on with its Walters 120 printer, with a price slap bang in the Epson range and a specification which, in some respects, is rather better than the best-selling Epson MX-80.

The most striking first impression of the Walters 120 is that it's built like the proverbial 'force-field latrine'. It weighs a hefty 12 kilos and is very solidly constructed — apparently one still functioned perfectly after being dropped down two flights of stairs, although I admit I didn't test this for myself! The machine is also rather larger than the MX-80, at 44 cm wide, 18 cm high and 33.5 cm deep.

The second impression one gets of the Walters is that, despite considerable amounts of soundproofing foam inside the case, it is rather noisier than the Epson, although future models will have even more thorough soundproofing, I'm told.

The Walters 120 has a 9-wire print head which sprints along at a claimed 120 characters per second. The standard typeface is a readable 10 characters per inch/80 chars per line but, by sending control codes to the printer, you can change to double width (40 chars per line) or condensed (132 chars per line). There is, in fact, quite a range of control codes to do all the usual things like setting tabs and form lengths but Walters has included several less usual but extremely useful ones, including decimal tabbing to align numbers to either the decimal point or — for European uses — to a comma.

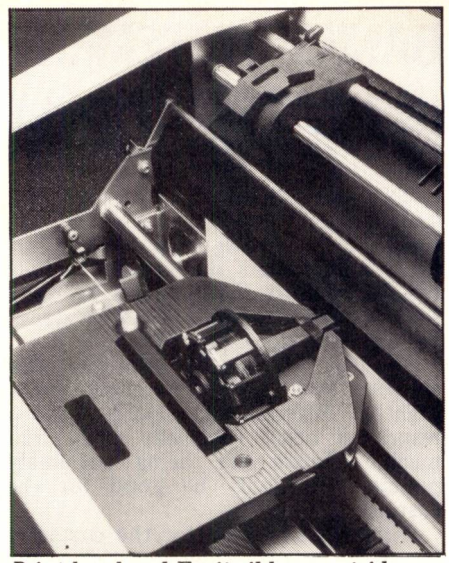
By far the most interesting facility, though, is the capability for the user to define up to 10 characters of his own by sending a stream of dot patterns. These are printed by sending another control code plus a letter in the range 'A' to 'J' (or 61H to 6AH) to select the particular character desired. I found this quite an easy operation to perform — both designing and printing, that is — and it's certainly a very useful feature, particularly if you have an application, such as in engineering, maths or science, which requires the use of special symbols. What could be pain, though, is trying to use these symbols from a word processing package.

The Walters 120 also has 64 predefined graphics symbols, activated by another control code, which would enable you to print forms and simple graphics designs. While the text characters are printed on a 9 x 9 matrix, graphic symbols use an 11 x 9 matrix, so the result looks quite good.

Setting up the Walters is very easy. The top lid lifts off completely and paper slides in through a slit at the bottom of the rear, keeping it clear of the power and data cables. You then simply push the paper in until it pops up in front of the print head and then pull it through to clip into the two tractor wheels. The lid can then be replaced.



*The robust Walters*



*Print head and Facit ribbon cartridge*

The printer has four controls — power on/off at the back and three pushbuttons on the front in a small panel, with four LED indicators. These pushbuttons allow you to reset the machine from an error (such as paper out), take the printer off line altogether, and perform line and form feeds. A self-test function is built in but is activated by an internal switch — fiddly but fair enough as you don't need to use it often. One particularly useful feature is the ability to set the top of form position using these front-panel switches — you line feed the paper until it's at the top of a page then press the reset switch. On an Epson, you set the top of form by switching off and on again — top of form is wherever the paper is when you switch on.

The Walters 120 comes with Centronics parallel interface as standard and optional RS232 and IEEE-488 interfaces. You get a properly typeset 30-page manual which clearly explains everything you might ever need to know and even gives you a few blank pages at the back for your own notes. It takes standard Facit ribbon cartridges (life 1.5 million characters) which are easily available from most computer and office equipment suppliers.

On the whole, I felt the Walters 120 was very good value for money. It's solidly built and should withstand very heavy use (the printhead is rated at 400 million characters), although it lacks some of the Epson's features (particularly bold and double-strike printing). In particular, the user-defined characters feature should make it very useful for anyone with specialised applications demanding non-standard characters.

## Prices

(excluding VAT and including UK delivery)

| | |
|---|---|
| Walters 120 | |
| with Centronics interface | £395 |
| with RS232 interface | £420 |
| with IEEE-488 interface | £428 |
| Average ribbon price | £2 |

*The UK distributor for the Walters 100 is Impact Data Ltd, tel: 01-952 7956*

```
This is a sample of normal printing
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And here's some
double width
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*Walters 120 print faces*

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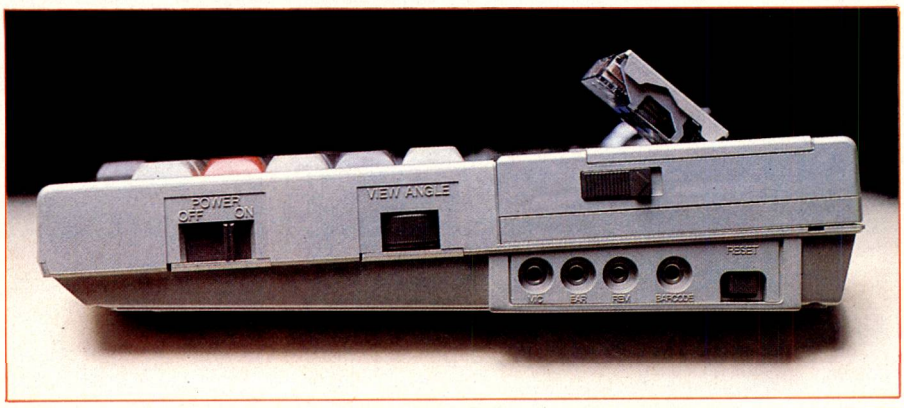
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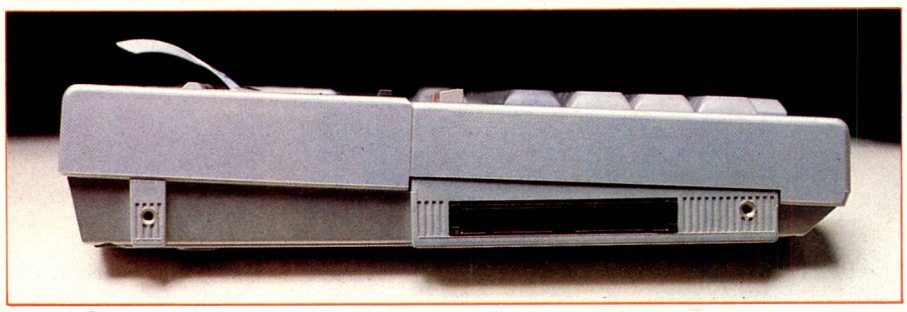
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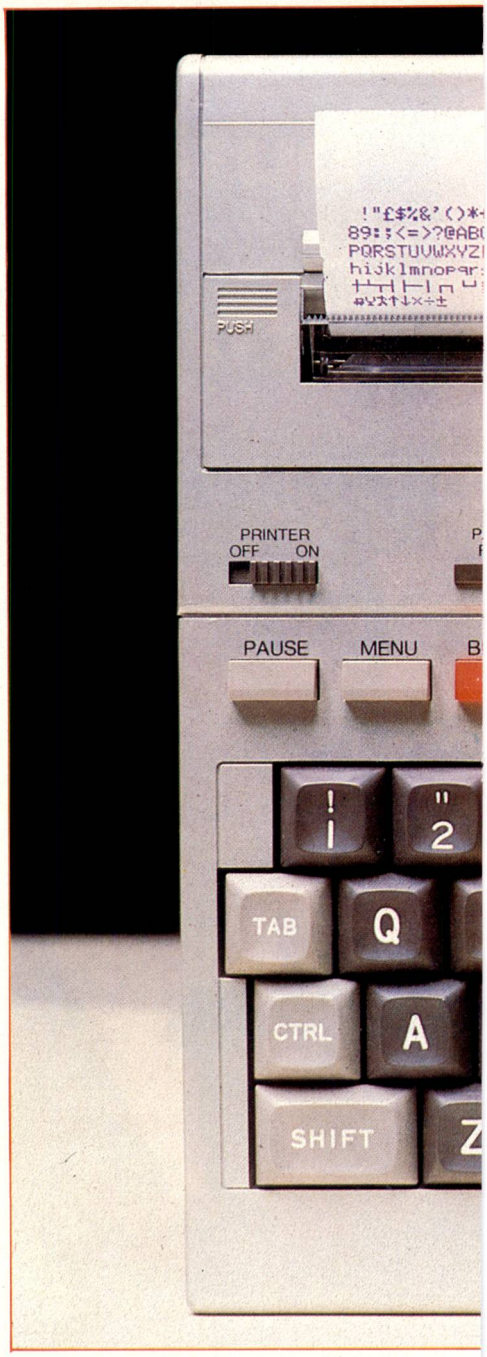
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# EPSON HX20






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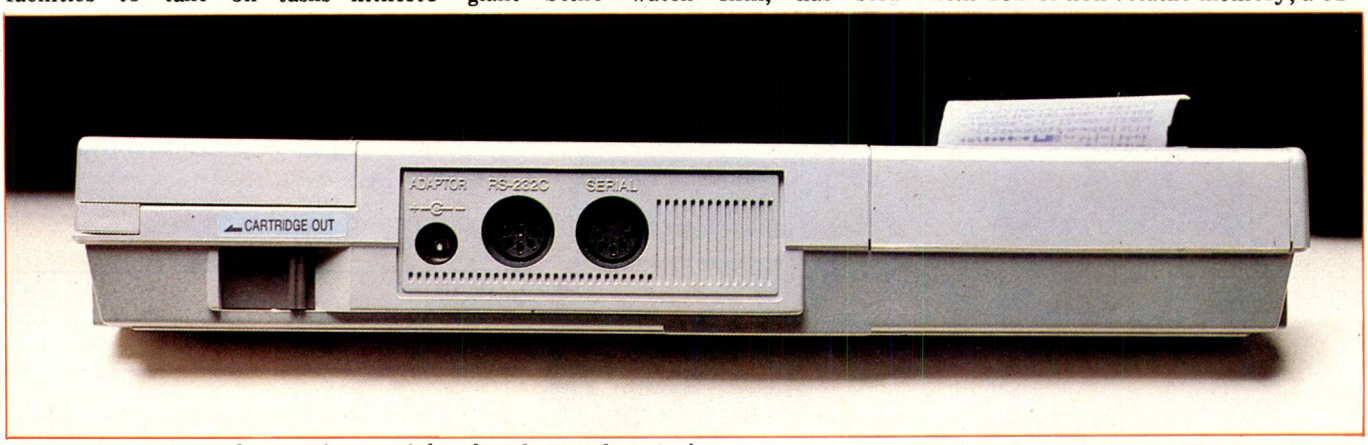
*Dick Pountain Benchtests a remarkable new portable computer from one of Japan's most famous manufacturers*

I said my piece on the future of hand-held computers in last month's review of the Hewlett-Packard HP75C and so will not take up space repeating it here. Suffice it to say that the subject of this review is the second general purpose fully portable microcomputer to reach the UK market; by general purpose I mean that it has the speed, memory and other facilities to take on tasks hitherto reserved for mains-powered machines and is not limited to mathematically oriented problems.

The HX-20 is also the first computer to be seen here from Epson, the Japanese firm which has achieved a remarkable dominance of the micro printer market in the space of three years. Epson, which is owned by the giant Seiko watch firm, has sold computers in Japan for some time but this is the first to be exported, and it will be followed soon by a series of desk-top CP/M machines.

## Hardware

As delivered, the HX-20 is a self-contained battery-operated computer with 16k of non-volatile memory, a 32k




*Photography by John Mason*

*Side and rear views show various peripheral sockets and controls*




Basic in ROM and built in four-line display and printer.

The outward presentation of the HX-20 is very neat and very Japanese. The case is moulded in that metallised silver plastic which has become a trademark of Japanese consumer electrical goods; the moulding is robust and intricate with many embossed legends and removable panels. All the screws which hold the assembly together go into moulded-in brass collets rather than naked plastic.

The case is exactly A4 sized (the size of this page) and the depth tapers from an inch and a half at the front to two inches at the rear. As you will quickly grasp, this is not a pocket-sized machine nor, at 1.6kg, is it even 'hand-held' in the traditional sense; you would need to support it in a crooked arm. Epson is deliberately calling it 'portable' not 'hand-held', but I suspect that 'lap-held' is the way most people will use it in the absence of a table; it will, however, slip into an ordinary briefcase without trouble.

The display is a 20-character by 4-line LCD unit (Epson leads the world in production of liquid crystal displays) which has no calculator type annunciators; it is treated exactly like a VDU screen of 120x32 dots. This screen is in fact only a 'window' onto a virtual screen whose size is user definable up to 255 characters by 255 lines and so can be scrolled in all four directions. A most unusual feature of the display is that the angle of view may be changed by adjusing a control on the side of the case; you sit in the position in which you want to use the machine and turn the knob until maximum contrast is achieved. Most previous LCDs can only really be viewed from square-on.

The keyboard is of standard ASCII layout and is not just good for a portable computer but good, full-stop. The keys are of low cushion shaped profile with recessed tops and have full-sized typewriter pitch, travel and a satisfying feel and feedback. The keyboard is fully debounced and appears to have a type-ahead buffer, which is useful as liquid crystal displays have a noticeable lag compared to a VDU. All the main keys have auto-repeat. TAB,CTRL and CAPS LOCK keys are provided, though the latter regrettably has no indicator to show that it's engaged. There is no numeric keypad but a shift key called NUM will turn a block of the main board into one for data entry. Another shift key called GRPH produces block graphics and symbols. Editing keys include CLR/HOME, INS/DEL and four-way cursor movement, but irritatingly the latter is done by two keys, cursor up and down being shifted. Along the top of the main keyboard are five programmable function keys, the PAUSE and BREAK keys and a key called MENU of which more below. In short this is a keyboard, for the first time on a portable, upon which I'd be happy to type all day. My only real criticism is that the keys are mounted directly onto a PCB which bends slightly under pressure (like the early Acorn Atoms); it would feel more robust if more ribs were cast into the case bottom to support it.

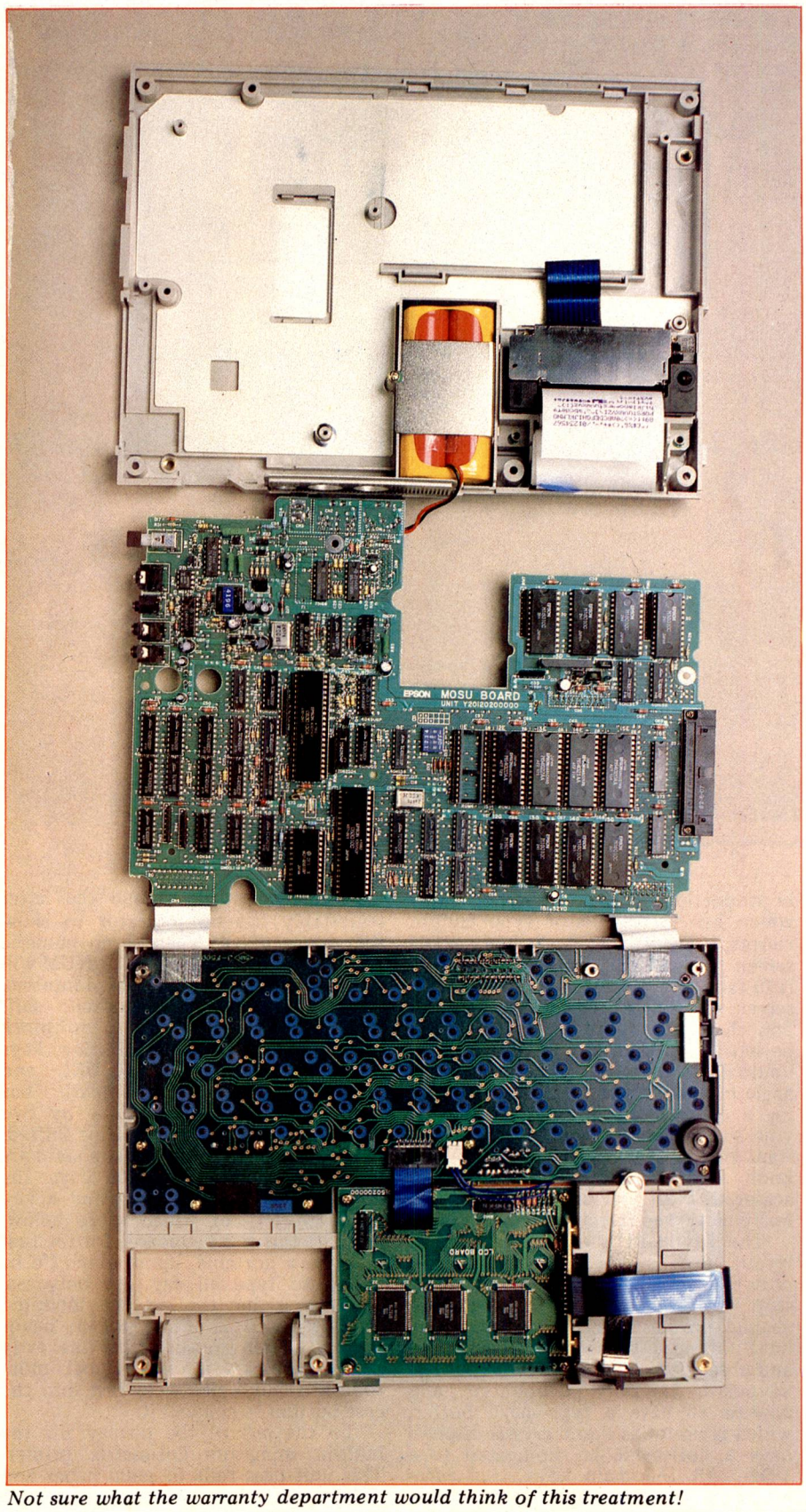
To the left of the display sits the built-in miniature dot-matrix printer. This unit uses rolls of plain paper and ribbon cartridges which are perfect

# EPSON HX20

Lilliputian copies of the MX-80 ones; the review machine had purple ink in it. The 2¼in paper accommodates 24 characters on a line and it can print the whole HX-20 set including the block graphics characters, as well as performing dot graphics. Operation is either under program control using LPRINT or manual, screen dumps being possible using CTRL and one of the function keys. The printer has its own on/off switch so that programs which have printer output can be debugged without wasting paper; it also has a manual linefeed button.

Printing speed is not fast at around 40 lines/minute but is comparable to other units of this size, while the print quality is much better than electrostatic 'silver paper' printers. Paper rolls are spindle-less and merely drop into a cavity under a hinged trapdoor, while changing cartridges is a cinch. The plain paper rolls are a standard size and so many office calculator rolls should work. They think of everything.

A third type of output is revealed by a grille just below the display. This conceals a piezoelectric beeper which is programmable for pitch and duration.




*Not sure what the warranty department would think of this treatment!*

Around the sides of the case are various sockets for connecting peripherals. The back panel holds two RS232C ports which have different DIN plug connectors. One is for communication with terminals, printers, other computers and modems at up to 4800 baud and has an 8-pin DIN socket. The other is for communicating with a TV or monitor via an adaptor, or to disk drives; it has a 5-pin DIN socket and a maximum transfer rate of 38,400 baud. At the left side is a parallel connector for the expansion RAM box, while at the right are mini-jack sockets for an external cassette recorder with remote control, and a bar-code reader. Finally, a socket next to the RS232 port allows an AC/DC power supply to be plugged in to recharge the NiCad batteries. These have a capacity of around 50 hours (they didn't need charging during this test) and take eight hours to charge; the computer can be used on the mains unit while they are charging but Epson warns not to use it this way once they are recharged as overcharging can shorten their life. I was rather suprised that the HX-20 doesn't auto-power down after a set interval as do most other battery-operated machines; best remember to switch it off.

The on/off switch is at the right hand side, as is the reset button; the latter is required only when a run-away program does not respond to the BREAK key or the on/off switch, which is only likely with machine-code programs. It does not perform a true cold start (which is done through software) and preserves all memory contents.

On a standard HX-20 the area to the right of the display is blank. It contains a dummy module which can be removed (using a very ingenious lever at the back) and replaced by either the optional microcassette drive or by ROM modules containing software. None of the latter were available for the test but the cassette drive was. This is a digital, not audio, device and uses standard microcassettes. It reads and writes at a fast 1300 baud and gets around 50k onto a 30 min tape. Although it has a tape speed of 2.4cm/s, which is the same as most pocket dictaphone recorders, Epson does not recommend swapping tapes between recorders. A really nice feature is the software tape counter which allows fast winding to the exact location of a program before loading; the tape position at any time can be read by a program. Using this feature cuts the time wasted searching tapes enormously and approaches the convenience of disk. The tape drive can be operated manually as well as under program control by pressing CTRL and the first function key. This turns all the function keys into tape deck controls, including one for zeroing the tape counter (which is displayed on the screen in this mode).

The ROM packs are unusual in that that they are accessed by a high-speed serial link and are treated, like other serial mass-storage, as a sequence of files rather than as part of the memory-map. They will be available in sizes from 8 to 32k.

Getting inside the case is quite easy and reveals some surpises. It is no sur-

prise that the manufacturing techniques are 'state-of-the-art'. The design is highly modular (the printer comes away as a sub-unit by undoing two screws) and uses two circuit boards, one for the logic and one for the keyboard switches. These are interleaved with sheets of a curious flexible metallised card which doubles as insulation and RF shielding. All intercard connections are by FCPs (flexible printed connectors) which are held by ingenious sliding grippers rather than those precarious sockets used on the Spectrum; they can be refitted over and again without damage. An interesting little anecdote; after I took the HX-HX-20 to pieces for that 'squashed hedgehog' photograph, I reassembled it and the RAM contents were still intact! The 16k of on-board CMOS memory is in eight 16k chips while the ROM is in four 64kbit chips which are socketed; there is a spare socket for 8k of ROM expansion.

The architecture of the HX-20 is unorthodox, to say the least. It has two CPUs, which are related as master and slave. They are both 6301 CMOS devices of Epson's own manufacture and have 4k of mask ROM and 128 bytes of RAM on the chip; they are reputed to be code-compatible with the Motorola 6800. The master CPU controls memory, keyboard, display, clock and bar-code reader using the external ROM while the slave CPU controls the printer, cassette recorders, RS232 and high-speed serial ports and low-battery power-off function using its on-chip ROM. Most unusually, the two CPUs talk to each other by the 38,400 baud serial link rather than parallel. One consequence of this is that the memory map is, to say the least, complicated.

There are plenty of other oddities which space prevents me from describing; one I must mention is that both processors go into a 'sleep' state to save power when not being used and must be woken up when required. A glance at the Benchmark timings will show that they are by no means fast (50 percent slower than the HP75C) but are no disgrace.

The overall impression given by the HX-20 hardware is that here is a level of professionalism in design and manufacture which would give me nightmares were I an occidental computer manufacturer.

## Firmware

The HX-20 operating system sits in ROM along with the Basic. Since all file handling for the cassette drives is done through Basic the operating system has very little to do with the user; it is responsible for the Menu selection function, managing the partitioned memory, cold and warm starting Basic (which includes setting the system clock) and responding to requests for manual control of the printer and cassette drive. Entry of machine code programs is done through a separate monitor which runs under the Menu function.

When you switch on the HX-20 the first reponse is always to present the menu on the display. The very first time you do it, it reads:

CTRL @ Initialize
1 MONITOR
2 BASIC

What this means is that to perform a cold start (which clears all memory contents and allows setting of the system clock) you must press CTRL @. Cold start also sets default values for user RAM size, amount of RAM file space and assigns 10 Basic keywords to the function keys. If you do this you will be prompted for the time and date; once you've entered these you will be returned to the above menu. You now have a choice of pressing the 2 key to enter Basic or 1 to enter the monitor.

Later on, when you have written some programs, up to five of these may be added to the menu so that they can be run immediately upon switching on the machine. The user RAM is divided into five partitions, called P1-P5, and each one may contain a separate program (or none). The partitioning is totally transparent to the user and you will only know it's happening if the total size of all your programs exceeds the total user RAM.

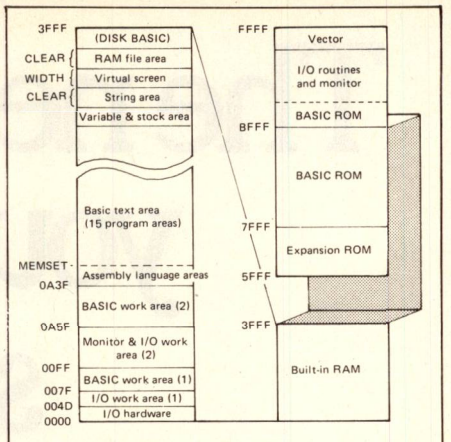
Unlike the Sharp and HP machines, there is no calculation mode; to perform calculations you must enter Basic and use PRINT 2+2, etc. Time and date can be displayed by pressing SHIFT and function key 1 from Basic but there is as far as I can discover no alarm function nor any of the sophisticated calendar functions of the HP75C; you can of course write your own alarm routine using the beeper.

Basic can be warm-started at any time (you must BREAK out of any running program) by pressing the Menu key; this returns the menu to the screen, and resets the default values for various system parameters such as the size of the screen but doesn't wipe out your programs. When you re-enter Basic, though, it is always into partition P1 no matter what you were in before warm start. In case you're wondering, no, you don't have to warm start to change program areas; that can be done from within Basic or even from within a program by the LOGIN x command which puts you into Px.

The monitor is quite a powerful program which has the ability to set breakpoints and change the contents of processor registers as well as the usual functions of dumping and changing blocks of memory and loading and saving binary files to tape. Coupled with the Basic MEMSET command which allows you to reserve space below Basic for machine code programs (the manual continually refers to them as 'Assembly Language' programs) this would be a very useful facility if only the instruction set were to be found anywhere in the documentation, which it isn't. If it is true that the processors are 6800-compatible this may not be a problem; I didn't have the time or the 6800 experience to find out.

One very neat feature of the monitor I should mention is the K command which lets you set up a 'boot' program which is automatically executed when power is switched on; if you wish it could be Basic itself so that you bypass the menu.

The amount of memory available to the user on the HX-20 is a whole story in itself. It depends not only on the setting of MEMSET but on space allocated for RAM files (see later) for strings, and on the size of the screen which you've defined. Of the 16k standard memory, the bottom 2624 bytes are used by the system (so this is the minimum value for MEMSET) and the most which can be allocated to Basic programs is 13,398 bytes with a 20x4 screen and no string or RAM file space. On warm start the default memory size is 12,891 bytes; adding the expansion memory pack would give 29,275 free bytes so the HX's advantage over the HP785C is not quite so great as it first appears in this respect.



*Master CPU Memory Map*

Although the business of controlling screen sizes and graphics modes is done from Basic I propose to deal with it here since the default values are set by the operating system.

There are two different screens available on the HX-20; a text screen and a dot-addressable graphics screen. There are two devices on which these screens can be displayed, namely the built-in LCD and an external TV or monitor. The text screen can be a 'virtual screen' bigger than the device, so that the physical device is a moveable window onto it. On the LCD both screens can be displayed superimposed on one another; on the TV you can show only one or the other but the graphics can be in colour. When you have picked the bones out of that lot you will realise that there is much to learn about the HX-20 screen, and I don't propose to teach you all of it here.

The size of the text screen is set by the WIDTH statement; for the LCD it can be up to 255x255 depending on available memory. For the external TV the limit is 40x37, of which the actual screen shows 32x6 lines. Since the TV adaptor was not available for test I'll concentrate on the LCD. When the cursor reaches the edge of the actual screen it 'drags' the window with it to the edge of the virtual screen. Alternatively you can move the window itself using control characters, in which case the cursor stays where it is. The cursor or the window can be sent to any point on th virtual screen using LOCATE or LOCATES x,y. It is possible to define margins round the actual screen so that that cursor starts to 'drag' the window before it reaches the edge; this makes life much easier as you can see if you're going to overwrite anything so the system defaults to a margin of four characters unless you tamper with it. In practice you soon get used to moving this window in two dimensions over a bigger screen and it becomes second nature. In Basic an excellent full screen editor is provided (with insertion and

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# EPSON HX20

deletion) so if you define a big enough virtual screen you can scroll upward through a listing or re-use commands previously entered. In doing this it pays to be careful that nothing else is lurking on the same line but off the screen!

The graphics screen is 120x32 dots for the LCD and 128x96 mono or 128x64 in four colours for the TV. If you use colour, however, a bizarre addressing mode prevails where there are 64 physical dots vertically but 96 addresses, so that either 0,0 or 0,1 will light the dot at 0,0 but only 0,2 will light 0,2 and so on alternately. Personally I never cared much for colour anyway, sniff...

## Software

Epson's Basic (originally called MFBasic but now EBasic) is a pretty substantial implementation of the language. It is much more orthodox and Microsoft-like than HP's 75C Basic but lacks the latter's modular programming facilities.

To write a program, select Basic from the menu and then either write it in P1 which comes up automatically or LOGIN to one of the other areas. AUTO line numbering, DELETE and RENUMber are all provided. To copy a program to another area use PCOPY x. If you wish your program to be added to the menu then TITLE it and it will automatically become the next item; the menu number is not necessarily the same as the P number but making a menu selection puts you into the right partition anyway. A program with a title cannot be NEWed or over-written until you give it a null title with TITLE "", which affords very valuable protection. STAT gives the title and size of a program and STAT ALL gives this for the whole lot and throws in the value of MEMSET and the RAMFILE space; a nice touch for homesick CP/M users. The function keys are easily set up by 'KEY number, "string" ' and the assignments can be inspected with KEY LIST or KEY LLIST for hard copy.

Error messages are rather more terse than I would like, but at least they have some mnemonic value and are not mere numbers; eg, SN ERROR (syntax), PP ERROR (protected program). There are over 60 of them including the intriguing 'Unprintable error'!

The HX can handle decimal, hex and, surprisingly, octal integers plus single and double precision (16 digit) reals. Variable names are up to 255 chars with a whacking 16 significant which should be enough even for the purist. Full type conversion functions are provided, type being indicated by the suffixes %, !, # and $. Arrays may have more than two dimensions.

The Boolean operators are remarkable for the inclusion of IMP(implication) and EQV(equivalence) in addition to the normal AND, OR, NOT and XOR.

Most of the rest is standard Microsoft, a single line DEF FN and IF... THEN... ELSE and the normal string functions including INSTR. INPUT is supplemented by LINE INPUT, which takes 255 characters without delimiters, and the unusual INPUT$ which reads a specified number of characters from the keyboard or a file and waits until they're all delivered. A powerful PRINT USING is supported to format numeric output. Error trapping by ON ERROR GOTO/GOSUB is included, too.

File handling is fairly orthodox, with a couple of nice flourishes such as LOF, a function which returns the byte length of an open file. The latest thinking on device independence has been implemented; files have a 'descriptor' in the format 'devicename: filename' (filename optional) and can be directed to another device by changing the name. Recognised devices are keyboard, screen, tapes, ROM packs, RS232 ports, and internal printer; floppy drives are not recognised as a new Disk Basic will be required to run them.

Program files may be saved in two forms — compressed binary or ASCII. All the files so far mentioned are sequential. Random files are supported in the form of RAM files. These sit in memory and can be written and read randomly by a program from any of the partitions as they occupy their own protected area. This area is set aside by issuing a CLEAR statement; as well as clearing numeric variables this can take parameters which set the amount of string and RAM file storage. Once allocated, individual files can be defined in this area using DEFFIL, which sets the record length and the offset in bytes from the beginning of the RAM file area of the first record. Data of any type may be mixed in one record. As RAM files do not have names it's up to you to keep track of what starts where; there are no absolute addresses to remember, only offsets. They are very handy for permanently storing look-up tables of much used constants or conversion factors as a means of passing parameters between programs.

Finally, while on the subject of storage, the cassette control statements are exceptional. TAPCNT is a system variable which keeps the tape counter reading. WIND xxx fast winds the tape to any given place xxx and MOTOR switches on or off an external cassette recorder. FILES will give a directory of the names and types of files on a tape, or any other storage device including a ROM pack.

The graphics commands are confined to PSET to plot a point, PRESET to unplot it and LINE to draw lines, plus a function POINT which tells if a given point is lit.

All considered, this is a very powerful Basic, biased if anything towards business use. It will be immediately familiar to programmers used to MBASIC, which is no bad thing.

No applications software was supplied with the machine, which was one of the first final production models with export ROMs in this country.

## Documentation

I was supplied with a Xeroxed copy of what looks like a fairly finalised user's manual and the technical manual. Both are excellent, somewhat to my disappointment as I have relied for several years on Japanese manuals to inject a little humour into otherwise turgid Benchtests. These really are different. For a start they're in English with only the very occasional hint they've been translated.

The user's manual starts with a straightforward and comprehensible account of the machine's features and how to get it running. This leads on to the main section on EBasic which is laid out in the same format as Microsoft's MBasic manual and is clear and comprehensive. There follows a good chapter on machine code programming (apart from the aforementioned absence of instruction set) and file handling. It ends with numerous appendices of character codes, control codes, error messages and an index by function of the Basic reserved words and functions. There is no alphabetic index to the whole manual, though.

The technical manual is remarkably detailed, going through all the hardware down to the signal and timing level and ending with full maintenance and repair instructions which are intended for the dealer and repair shop. If you're a hardware junkie make sure you get this manual as well as the user one.

To summarise, a quantum leap forward from the stereotype of inscrutable Japanese documentation.

## Expansion

There is room for 8k more of ROM on the main board, which may be used for alternative language character sets. An expansion module which fits externally onto the left side of the machine contains 16k of RAM and a further 16k ROM.

ROM modules which fit in the place of the microcassette drive are somewhat different from ordinary ROM in that they are treated as file-oriented read-only mass storage.

A TV/monitor adaptor should be available by the time of the launch in November, and a bar code reader for

*GOTO page 200*

## Technical data

| | |
|---|---|
| Processors | Twin 6301 (CMOS) 0.6MHz |
| Dimensions | 290mmx215.5mmx44mm |
| Weight | 1.6kg |
| Power | Rechargeable Ni/Cad cells 4.5-6.0V |
| RAM | 16k CMOS standard. 32k expanded |
| ROM | 32k |
| Display | 20 col x 4 row LCD; 120x32 dot graphics |
| Keyboard | ASCII standard 68 keys, including 5 programmable function keys |
| Printer | Micro dot-matrix 24 chars/line, 144 dots/line, 150ms/dot line. |
| Ports | RS232C up to 4800 baud, High speed serial up to 38,400 baud |
| Language | EBasic |

# ADA– A BRIEF ENCOUNTER

*The US Department of Defense is interested in Space Invaders of a rather more dangerous variety than we micro folks are used to. It has chosen Ada as the language to implement all future defence software. Mike Parr explains why. . .*

Rarely does the design of a new programming language cause emotional discussion, but the introduction of Ada, the language selected by the US Department of Defense (DoD) is the exception. Basic, Forth and Pascal all have their critics, but the Ada debate is at a different level because of the sensitive area of its use — missile control, nuclear power plants, etc. Here I'll present a brief overview of the language, together with the arguments (sorry — discussions) on its value. I will attempt to be neutral!

## History

In 1975 the US DoD decided to standardise on its programming language, and put out tenders for a language design to several firms. The winner was eventually called Ada (after Ada Lovelace, who worked with Babbage on an early mechanical computer). The language is based on Pascal, but has important additions to allow for real-time control, and to assist in the production of large software systems by teams of programmers. Because of the area of its use, the handling of errors is also vital — if your Space Invaders game crashes it is merely annoying, but if a fault occurs in a nearby nuclear power station you might be more concerned.

However, before criticising Ada, let's look at some features of the language.

## What is Ada?

Fundamentally it is a Pascal-like language with these features:
Strong data typing.
Separately compilable 'modules'.
Facilities for the simultaneous execution of tasks.
(An explanation of this jargon will follow!)

However, Ada is more than just a language — it comes with a set of software tools collectively known as APSE (Ada Programming Support Environment), comprising editor, testing software, etc. In fact, APSE can handle all the paperwork associated with a project. Secondly, as Ada is a higher-level language than Pascal, it can be made use of at the program design stage, where one might have used pseudo-code or flowcharts. Certainly, a detailed study of Ada will affect the way you think about large programs, and the module and procedure facilities will encourage a 'divide and conquer' approach, making programs easy to read: after all, programs are read many times during development. (Forth fans please note!!)

## The Ada attitude

Because Ada is intended for large programs, small examples are not always realistic — however it might be useful to approach the Ada way of thinking (on errors, reliability, etc) by criticising some fragments of MicroSoft Basic. Firstly:

```
10 IF F THEN 30
20 PRINT F * 3.142
```

These two lines have the following drawbacks:
The intial value of F is unclear (in fact it is zero).
F is rather meaningless — we would prefer longer names, eg, FLAG.
In Basic 1 (or —1 in some dialects) means 'true'. When F is zero, line 20 will be obeyed, and the missing line 30 will not produce an error.
In line 20 we multiply a logical (boolean) variable by a real number. What is the meaning of 'false'*3.142?

This brings out several points (bearing in mind that programs may be used in life-or-death situations) — ie, that incomplete programs should not be allowed to run, and that the type of each variable should be specified by the programmer to allow the compiler to reject misconceived operations. This feature, also present in Pascal and Algol 68, is called 'strong typing' and though it sounds like a good idea, is not popular among all programmers.

Now a subroutine to find the average value of the elements of an array:

```
1000 REM AVERAGING ROUTINE
1010 S = 0
1020 FOR I = 1 TO 100
1030 S = S + A(I)
1040 NEXT I
1050 AV = S/100
1060 RETURN
```

Again there are drawbacks:
The routine will only work on an array A, of size 100.
It also affects the value of I and S, which may be in use elsewhere in the program.
We may not want the user to have the power of editing the routine — it may be dangerous in certain environments.

These problems, present in Basic (and to some extent in Pascal) are all overcome in Ada. Bearing in mind the 'safety first' approach, let's look at some areas of the language.

## Control structures

Here at last is a fragment of Ada, illustrating the familiar FOR loop of Basic and Pascal —

```
SUM: = 0 -- initial value
FOR INDEX IN 1 . . 100 LOOP
   SUM: = SUM + A(INDEX);
END LOOP;
```

Upper or lower case characters can be used for variables or reserved words, but I'll stick to capitals to differentiate programs from commentary. The layout is similar to Pascal but note that comments are preceded by '--', and that a semi-colon must follow each complete statement.
As well as FOR, we have WHILE, as in: —

```
WHILE X<11 LOOP
   any statements
END WHILE;
```

or even more simply, an infinite loop —

```
LOOP
   any statements
END LOOP;
```

The idea of WHILE is that one collects together the terminating conditions at the head of the loop, though sometimes it is simpler to break out from the loop body; in recognition of this practical requirement. Ada provides an 'exit' statement as in:

```
LOOP
   EXIT WHEN X<0.0001;
END LOOP
   -- next statement
```

We may also use GOTO in such a situation.

As well as repetition, we need statements for selection, and Ada provides IF and CASE, each being more powerful than their Pascal counterpart. The form of an IF is —

```
IF condition THEN statements
ELSIF condition THEN statements
ELSIF condition THEN statements
   etc
ELSE statements
END IF;
```

Note that this is one statement, *not* a series of nested IF's. You *could* choose to nest the statements by writing ELSE IF instead of ELSIF but each IF would need a matching END IF, which becomes clumsy.

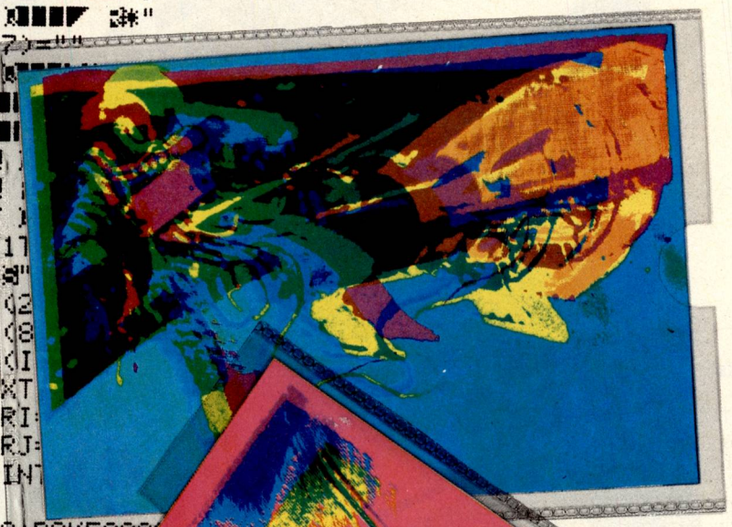
The CASE statement at first sight seems similar to the IF, as in

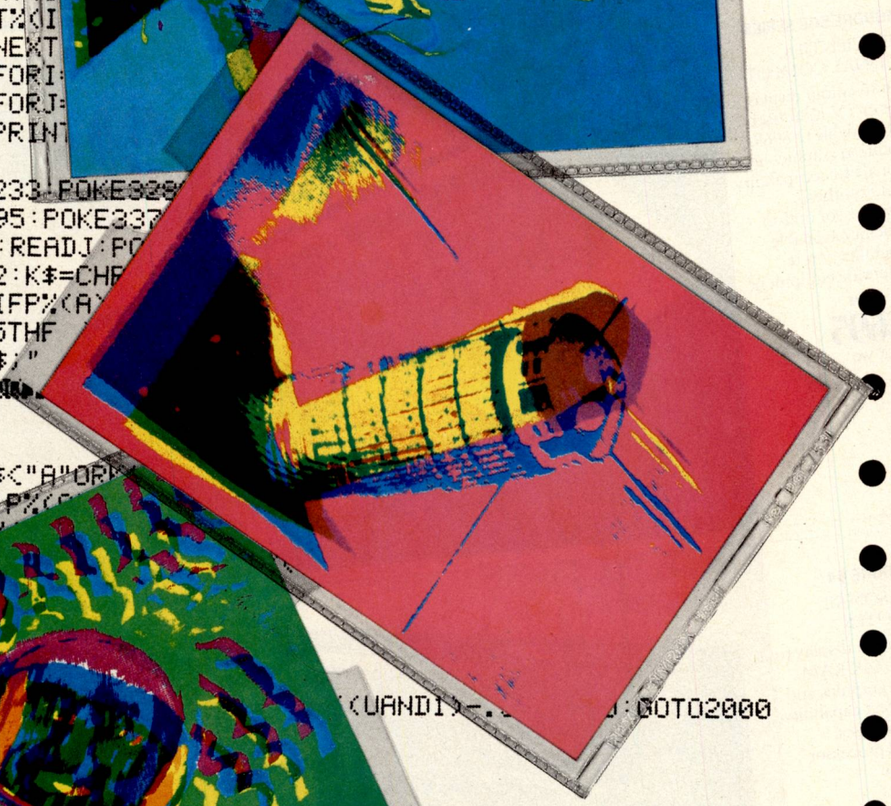
```
CASE EXAM_MARK IS
   WHEN 100 = >
```

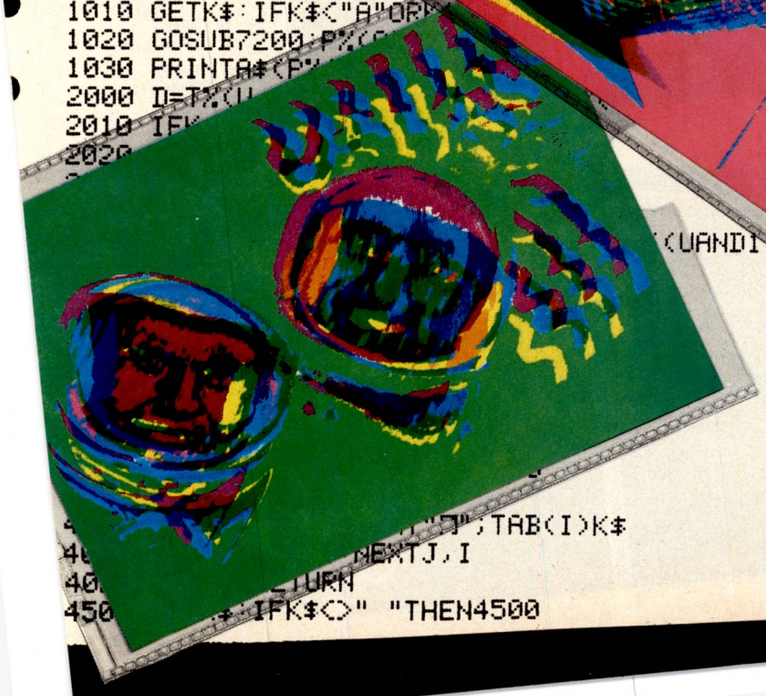
*Illustration by Ian Wright*

```
200 D$="
210 A$(0)="
220 A$(1)="
230 A$(2)="
240 A$(3)="
250 A$(4)="
260 A$(5)="":A$(7)=""
270 A$(6)="
280 A$(8)="
290 A$(9)="
300 A$(10)="
310 A$(11)="
320 A$(12)="
330 Z$="":FORI=1
340 NEXT:Z$=Z$+"
350 IFV<.2THENA$(2
360 IFV<.4THENA$(8
400 FORI=1TO8:T%(I
410 T%(I,3)=X:NEXT
500 PRINT"":FORI
510 GOSUB7000:FORJ=
520 GOSUB7100:PRINT
530 GOSUB7000
540 POKE32849,233:POKE32
550 POKE33689,95:POKE337
560 FORI=0TO10:READJ:PO
600 FORI=65TO82:K$=CHR
610 GOSUB7200:IFP%(A
620 IFRND(1)<.5THE
630 PRINT"";K$;"
640 PRINT"
650 B=TI
1000 T=TI
1010 GETK$:IFK$<"A"OR
1020 GOSUB7200:P%(
1030 PRINTA$(P
2000 D=T%(U
2010 IF
2020
                                    (URND1)<.2
                                                    :GOTO2000
                                    "";TAB(I)K$
                    NEXTJ,I
                    URN
450                 *:IFK$<>" "THEN4500
```









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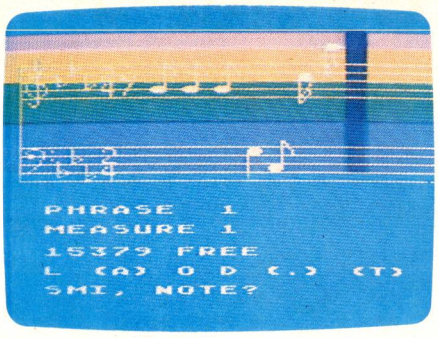
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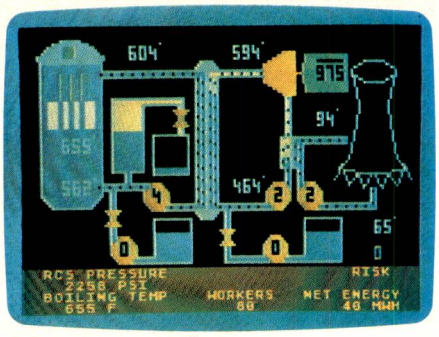
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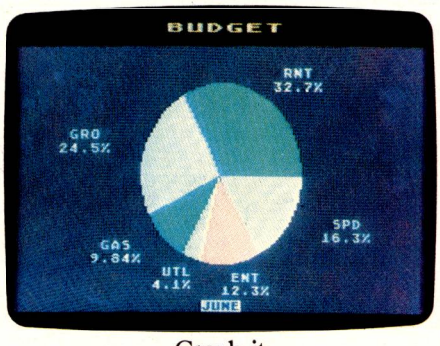
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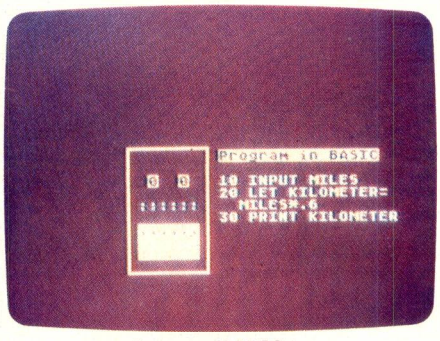

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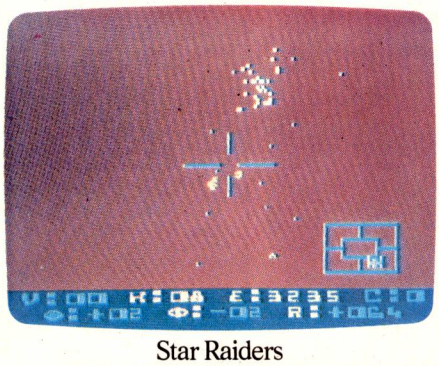

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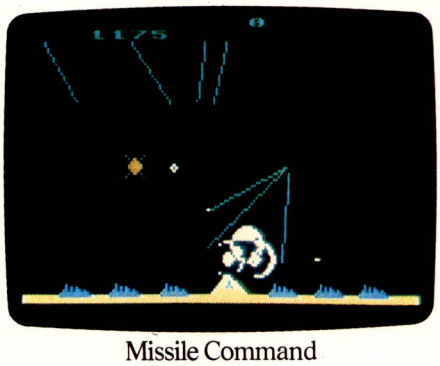

Intro to BASIC 1



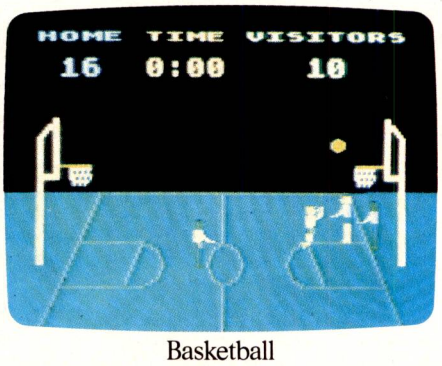
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# ADA–A BRIEF ENCOUNTER

```
    PUT ("AMAZING"); --put is
'write'
  WHEN 80 . . 99 = >
    PUT ("GENIUS");
  WHEN 60 . . 80 = >
    PUT ("GOOD");
  WHEN 35 . . 59 = >
    PUT ("AVERAGE");
  WHEN OTHERS = > -- ie, default
    PUT ("UNCLASSIFIED");
END CASE;
```

Ada insists that we must cater for every possible value of the selecting item (ie, EXAM_MARK), and also that no two WHEN items include the same values. Moreover, Ada will check this before running the program. In fact, there is an error in my CASE example, because 80 has been specified in two options — the program would produce a compile-time error. You might feel that such a checking facility is impossible, but, to accomplish this, Ada will not allow you to use variables in a WHEN item because variables can be checked only at run-time. The point of all this red tape is a statement which will not inadvertantly fall through to the following statement, and whose effect is not altered by re-ordering the WHEN list.

Finally, one overall point on CASE, IF, WHILE, and FOR is that the Pascal BEGIN/END scheme has been rejected in favour of more meaningful terminators — ie, END CASE, END IF and END LOOP.

## Data types

This is a major part of Ada, and occupies about 30 pages of the reference manual. Because of this range, I'll examine the more novel features.

Initially, we have built-in types similar to Pascal, eg:

```
COUNT, I: INTEGER;
SUM: FLOAT: = 1.0; -- and initialise
A:ARRAY (1 . . 100) OF INTEGER;
```

We may also form 'derived' types as in:

```
TYPE VOLTS IS NEW REAL;
TYPE AMPS IS NEW REAL;
X,Y: VOLTS: = 0.0;
A,B: AMPS: = 1.0;
```

and can now write statements such as

```
X: = Y + 6.0;
A: = A + B;
```

but *not*

```
X: = A;
```

because the items are of different types.

The declaration of numeric types is worth looking at, as it is a considerable advance on Pascal. We can declare a limited range for an integer as in:

```
TYPE WEEKS IS RANGE 1 . . 52;
X: WEEKS;
```



but the novel point in Ada is to apply this to reals, and specify the range and precision:

```
TYPE FRED IS DIGITS 10
  RANGE –100000 .. 100000;
X,Y: FRED;
```

Here, we have said that, whatever the size of word on our computer, X and Y must be held to at least 10 digits of precision. Though Ada was not specifically aimed at numerical work, it provides better facilities than Basic, Fortran, or Pascal because programs will run on any machine, irrespective of the number of bits per word.

Arrays are defined in a similar manner to Pascal, but the actual size (within certain limits) can be left until run-time. Because array elements can be of any type (eg, character) and the size of arrays is flexible, we automatically have character strings; and because functions can return arrays as results, we can easily write powerful string functions. A simple example of procedure which prints out every element of an array of any size is:

```
PROCEDURE   ARRAY_PRINT
(A:ARRAY) IS
FOR I IN A'FIRST. . A'LAST LOOP
  PUT (A(I));
END LOOP
END ARRAY–PRINT;
```

Here we have made use of the reserved words FIRST and LAST, which find out the actual limits of the array index.

## Program units

An important requirement in a language is that it allows the programmer

a) to split large programs into smaller manageable chunks (eg, subroutines in Basic);

b) to incorporate standard library packages in a program;

c) to write packages which can be safely used by other programmers.

Most languages do not meet these requirements!

Ada provides us with enhanced Pascal-style procedures and functions, plus two types of module called 'packages' and 'tasks'. As usual, I'll concentrate on the differences from Pascal.

Firstly we can 'overload' (enhance the meaning of) the arithmetic operators. As an example, we could overload the '+' operator to perform matrix addition. Assuming that the type MATRIX has been defined as a two-dimensional array of any size, we can add corresponding elements by:

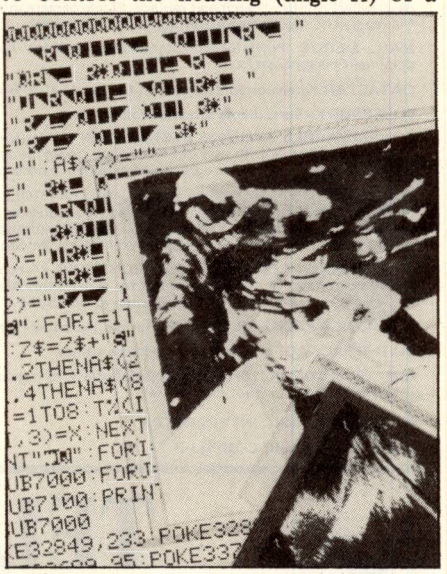
```
FUNCTION "+" (X,Y:MATRIX)
    RETURN MATRIX IS
SUM:MATRIX;
BEGIN
FOR I IN 1 . . X' LAST(1) LOOP
  FOR J IN X'LAST(2) LOOP
    SUM(I,J):=X(I,J) + Y(I,J);
  END LOOP;
END LOOP;
RETURN SUM; -- ie, the result
END "+";
```

and we may now use '+' to work on matrices.

## The package

For safe programming, the Pascal rules on the scope of variables are inadequate — ideally we want to provide a set of procedures for other users and also prevent the user from interfering with the internal workings. Consider a TV set — it is sealed up to keep out unskilled hands but can be manipulated to a limited extent by a set of controls on the front panel.

We can see why standard Pascal is unsafe by looking at an attempt to provide a set of 'turtle graphics' procedures. The requirement is to control the heading (angle A) of a




point on the screen by two procedures LEFT(N) and RIGHT(N), where N is any angle in degrees. We could try:

```
PROCEDURE LEFT (N:INTEGER);
VAR A:INTEGER
  Body of LEFT;
PROCEDURE RIGHT(N:INTEGER);
VAR A:INTEGER;
  Body of RIGHT;
```

Here, the programmer attempts to convey that variable A is 'private' to LEFT and RIGHT and must be updated only by these procedures. The problem is that as soon as the program exits from LEFT, all local variables (including A) are lost. In fact, such a variable needs to exist throughout the running of the program, and so must be declared at the outermost global level. Unfortunately, such variables can be accessed by any part of the program.

However, in Ada, we can declare a package, typically consisting of a set of procedures and data items, such that variables within it are inaccessible from outside the package, yet keep their value between procedure calls. For turtle graphics, we could write:

```
PACKAGE TURTLE IS
PROCEDURE LEFT(N:INTEGER);
PROCEDURE RIGHT (N:INTEGER);
END
PACKAGE BODY TURTLE IS
A:INTEGER;
-- followed by the body
-- of LEFT and RIGHT
END TURTLE;
```

## Tasks

Many computing applications involve the simultaneous action of several tasks, such as writing to several VDUs at once, controlling a chemical reaction, or animating a Space Invaders game while detecting the player's move. Ada allows several tasks (similar in definition to a package) to be run together by high-level statements, whereas one is accus-

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# ADA–A BRIEF ENCOUNTER

tomed to dropping into assembly code to deal with interrupts, etc. In Ada, aside from a minimal amount of assembler which may be needed to address novel peripherals, the interrupt is treated as a low-level device that is hidden from the programmer by the language. Indeed, it is interesting to note that Ada, as well as allowing one processor to switch between several tasks in the conventional manner, will also allow the programming of systems in which each task has its own processor — ie, the program is distributed between several machines. In this area of real-time programming, potentially involving dangerous situations, it is realistic to expect errors, either within the programming system itself (eg, division by zero), or errors in results which can be detected by program. Bearing in mind that an error may be detected deep inside a series of nested procedure calls, Ada allows the programmer to specify an action to be taken when a particular 'exception' occurs, and also to control how many partially completed procedures are skipped before normal processing resumes.

## ...and

Yes, there's more. Particularly in the area of modules, data types, and input/output (provided by a set of procedures written in Ada), but if you want more detail, try one of the books listed below. However, bear in mind that it will be some time before you will be able to run Ada on your micro.

## The debate

'Coherent'; 'versatile'; 'unwieldy'; 'baroque'; 'almost impossible to implement'; 'unreliable'.

These phrases come from recent Ada articles in the computing press; the anti-Ada faction maintains that it has features grafted together to allow for any possible requirement, making it a very large language, difficult to understand and use. If the language is incomprehensible to most programmers, will the programs they produce be of poor quality? Well, the point about complexity is true — many programmers will find Ada difficult, so perhaps the choice of a Pascal-like subset might be appropriate. On the other hand, real-time systems are complicated in any language, so perhaps one which acknowledges their existence is an improvement. However, one of Ada's strongest opponents, Professor Hoare of Oxford University, says that it must never be used to implement large software systems because it is unreliable in the areas of error-handling and multi-tasking. Bearing in mind that the DoD has had several false alarms in recent years, such criticisms are indeed serious.

## Where is Ada?

As Ada compilers are reputed to be six times larger than Pascal compilers, full Ada is not likely to appear on today's typical micro system. Currently though one can purchase micro Ada subsets from the USA, and for Motorola 68000, DEC, and IBM 370 systems from Telesoft in the UK. York University is also well advanced towards a full Ada compiler.

## The future

Will it catch on? Opinions differ, but it will have to overcome Cobol/Fortran inertia from industry — though some firms involved in real-time programming are keen. Ada subsets (eg, without the multi-tasking facilities) will become more widespread, competing with Pascal on CP/M systems.

Perhaps the personal computer language battle will end up being fought between Unix plus 'C', Pascal, Smalltalk, and Ada?

## Further reading

The number of Ada books is increasing rapidly, so this is not an exhaustive list.

*Programming With Ada* by Wegner — published by Prentice Hall.

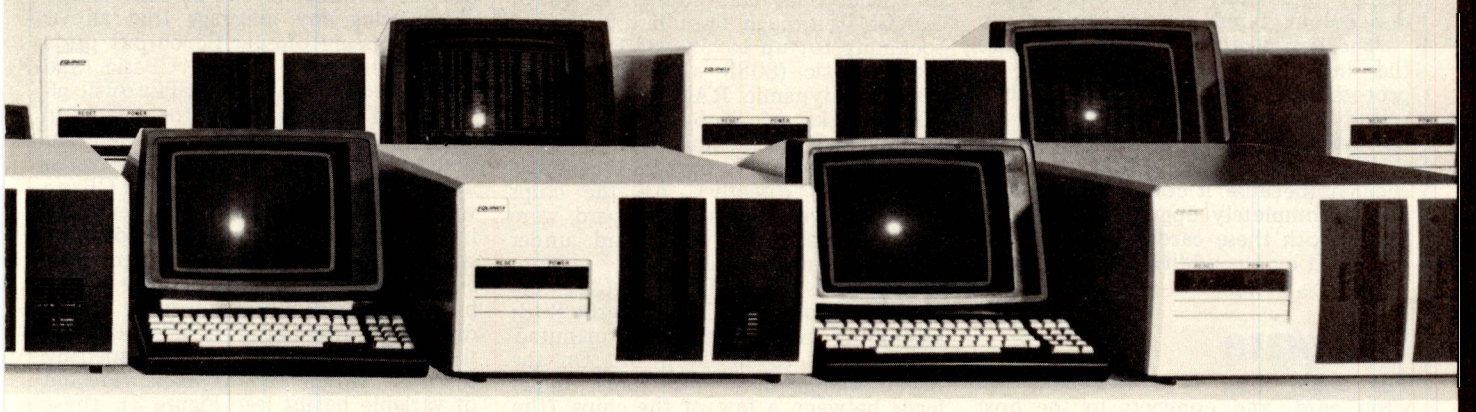
*Ada — An Introduction* by Ledgard — published by Springer-Verlag (also includes the Ada reference manual).

*Problem Solving With Ada* by Mayoh — published by Wiley (uses turtle graphics in many of the examples).

*The Ada Programming Language* by Pyle — published by Prentice Hall.

END


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CHECKOUT

# PLUTO POWER!

*Add more muscle to your colour graphics with IO Research's Pluto board. Joe Whelan investigates.*

As the cost of processors and RAM drops, we are likely to see more and more multiprocessor machines to be sold either as rack systems or as add-on units; the BBC machine is a good example of the latter. These multi-processor machines will also tend to have dedicated processors, for such things as screen control (for example, the review system contains an 'Intelligent Video Controller' card with its own Z80A processor), which will have their own RAM, input/output ports and the ability to perform multi-tasking.

The uses to which these systems can be put are extremely varied and will tend to form a source of extremely powerful, small and yet relatively cheap computers: the new DEC Rainbow is a very good example, with 16-bit and 8-bit processors and running all CP/M software. The really interesting point for most micro users is that machines such as the ACT Sirius and the IBM Personal Computer don't have this nice facility, and so an add-on board must be made to contain the second processor, which means it may also be possible to link these optional boards up to other micros. A second processor would be extremely useful, if not a prerequisite: especially for the Sirius, Galaxy and many others which don't have colour graphics as standard.

The first British company to realise the impact that an add-on, 16-bit processor board dedicated to graphics would make is IO Research Ltd. IO has produced two options of the board — 'Pluto' and 'Baby Pluto', which is cheaper (because it contains less RAM) but is completely upgradable to a full Pluto. Both these cards can be further expanded by the addition of the palette board (see later).

## Hardware

The board itself is a well-made 8in x 8in card, and connects to the host computer through an 80 BUS or NAS-BUS edge connector (80 pins).However, the manual gives the data for each of the lines, and so it can be connected to any host computer which has two 8-bit parallel I/O ports (see Figure 1 for details). Any computer without this facility can be linked to the Pluto by direct connection to the bus: IO Research has at present connected the following machines up to a Pluto: Apple II, Sirius, PET, BBC, Gemini and IBM. The machine used for this review was a Gemini Galaxy 1 (which is based on the Gemini multiboard cards and contained the CPU/RAM/IO card, IVC card and disk controller card) which uses the 80 BUS system and hence allowed the Pluto board to be simply plugged in. The board can also be bought together with a case which will take all future expansions: this is necessary for all those machines which have a design criterion of good looks rather than expandability — such as the Sirius, which has virtually no room left inside the case for expansion. It will also accommodate the power supply, which is not a trivial matter seeing as the Pluto board alone draws a current of around 1.8 amps.

The processor on the board is a 16-bit Intel 8088 running at 6MHz, although there is also a faster 8MHz version which has just become available which gives a 60 percent increase in speed. This was addressing 4k of EPROM (although the board contained socketing for up to 32k of ROM) and 2k of static (8088 work space) plus 192k of dynamic RAM, consisting of three banks of 8x64k RAM chips, all 150 nS cycle time (the 8088 is capable of accessing over 16 megabytes of memory directly). All the chips on earlier versions of the board were socketed (as was the board under review); however, on later versions all chips bar the RAM and the CRT controller are soldered directly to the PCB: something more and more manufacturers seem to be keen on. On the review sample there were some jumper leads between a few of the chips. (I'm not certain of the exact functions of these jumpers but they appear to be used so as to allow for future expansions/options and to configure the board for different systems.) The connection to the monitor was through a 20-pin plug; the output is for an RGB monitor or composite video signal — note the Pluto can be used on single-colour monitors but only the green plane can be displayed. The CRT controller is a Hitachi 46505SP and there are two oscillators, one of which is the Pluto system clock and the other being, presumably, the oscillator for the CRT controller (IO Research, after many enquiries, is planning to make this oscillator synchronised to an external source — eg, for television studio work). There is also a larger 50-pin connector which was for connection to the palette board which is due for release shortly. The quality of the colour generated is excellent and could only really be appreciated on a high-resolution colour monitor. All the input/output on the board is fully buffered to allow for easier control of the Pluto card by the host processor.

| | |
|---|---|
| 1-4 | GND |
| 23 | WAIT |
| 26 | IORQ (kept at 0) |
| 28 | WRITE STROBE |
| 29 | READ STROBE |
| 30 | DATA/STATUS SELECT |
| 31-34 | LOGIC 0 TO SELECT PLUTO |
| 35-37 | LOGIC 0 TO SELECT PLUTO (depends on set of linkages on board) |
| 50-57 | BI-DIRECTIONAL DATA BUS |
| 75-78 | +5 Volts |

Note: all other signals are 80 BUS specific and are not required by the Pluto board

*Fig 1 Interface connections for a non-80 BUS system*

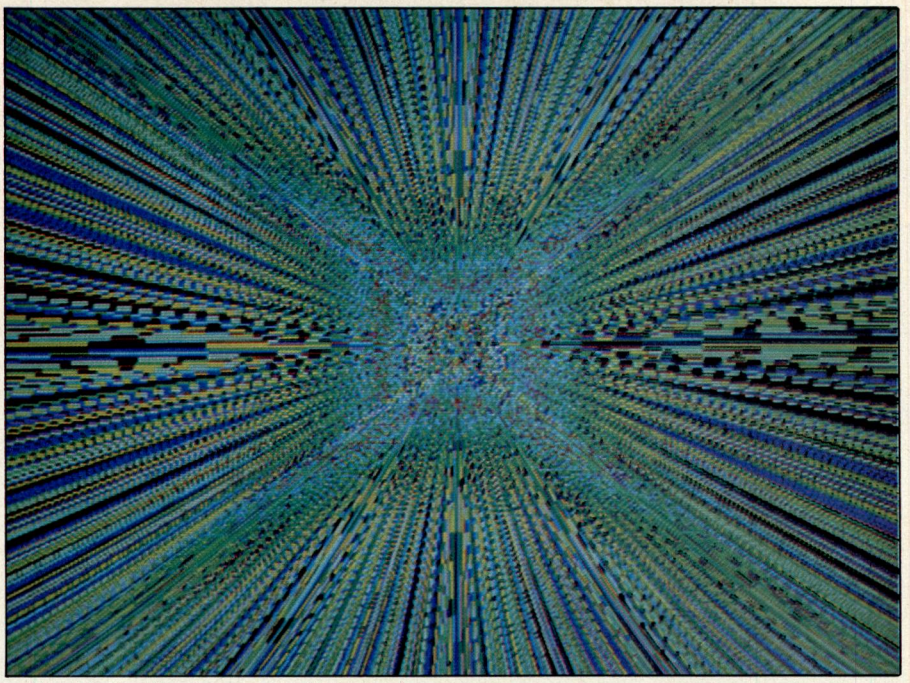
## Software

The software is contained in the 4k EPROM, and is generally well thought out, and the commands are comprehensive and powerful, if sometimes complicated. Commands can be sent to the Pluto using any language that allows the addressing of specific output ports — for example, Basic, CBasic and machine code: with Basic the Pluto will always beat the interpreter for speed and so no checking of the status of the Pluto board is required. However, when writing in machine code (and in CBasic when the command sent previously involved a complicated operation) the status must be checked. The memory is considered as a block which is 640 pixels wide and 800 pixels high. This is divided up into a number of 'partitions', the number of which can be varied by the user , which are 640 pixels wide and of variable height (see Figure 3). These partitions can be used for anything that normal memory is used for, such as data storage or program storage. However, the first two partitions (numbers 1 and 2) are used for the screen display and are predefined to be 640 pixels wide by 288 pixels high: these can be used for super-fast animation as one screen can be displayed while the other is being redrawn. The remaining partitions are capable of containing various symbol tables, eg, character sets, in addition to the predefined ASCII character set for text display which is stored on the onboard ROM: these are defined as an 8x10 matrix which, although good, is not up to the same definition as the Sirius: presumably the characters

are defined in this way so as to make an 80 by 28 screen display.

The actual screen display is defined as a pixel matrix of 640 across by 288 high, with the origin at the top left hand corner. The memory is organised so that one pixel is defined by three bits (giving eight possible bit patterns); this allows the choice of one of eight colours per pixel and there are no restrictions on the arrangements of the various coloured pixels on the screen. In addition, with a small amount of laborious work, these pixels can be grouped to give the impression of other colours.

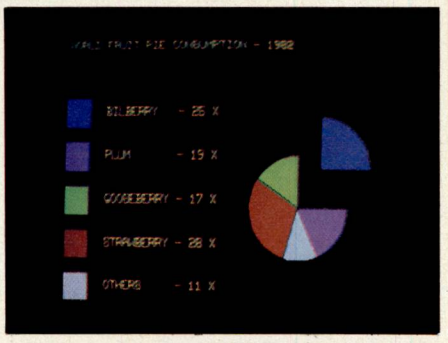
The commands for control of the screen are very comprehensive: see Figure 4 for the complete list and explanation of the commands. They contain procedures for move, move relative, draw, draw relative, plot point and plot point relative. Each of the relative commands is then subdivided into a long and a short version. The reason for this is that the commands are sent down to the Pluto board as one-byte codes. On receipt of the command code, Pluto will expect a fixed number of data bytes, depending on the command given (one word of warning here; the status port on the Pluto should be checked before sending data to the card as if any information, especially the command and first data bytes, is sent but not read the Pluto will wait for more data or misinterpret any future data). If the command is to move the 'current position pointer' (IO's word for an invisible cursor) relative to its present position, then the move may be either greater or smaller than 127: 127 if the move is positive but 128 if it is negative. If it's greater than 127/-128, two bytes will have to be sent to Pluto for both the X and the Y coordinates. This would mean a total of five bytes to be transmitted, as opposed to only three if the required move is less than 127 pixels in both the X and the Y directions. It may seem a little silly at first

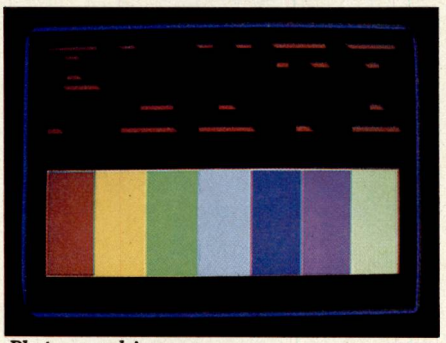


to duplicate these commands, but when you realise that in order to send the data you have to calculate and then send it as two sets of low and high bytes it does save a lot of time using the 'short' instructions: hence it is usually much easier to send two 'move shorts' instead of one move. To tell the truth, I always found it much easier to use only absolute instructions because all the relative instructions, quite logically, require the bytes to be signed. It is possible to lighten the mental load when programming for the Pluto by using lines in your programme such as:

```
1000 N - 166
1010 Y - A * B
1020 OUT N, Y AND 255, Y/255
```

where N is the output port number, line 1010 sets a value for Y, and line 1020 sends low byte followed by high byte.



*Pluto graphics*

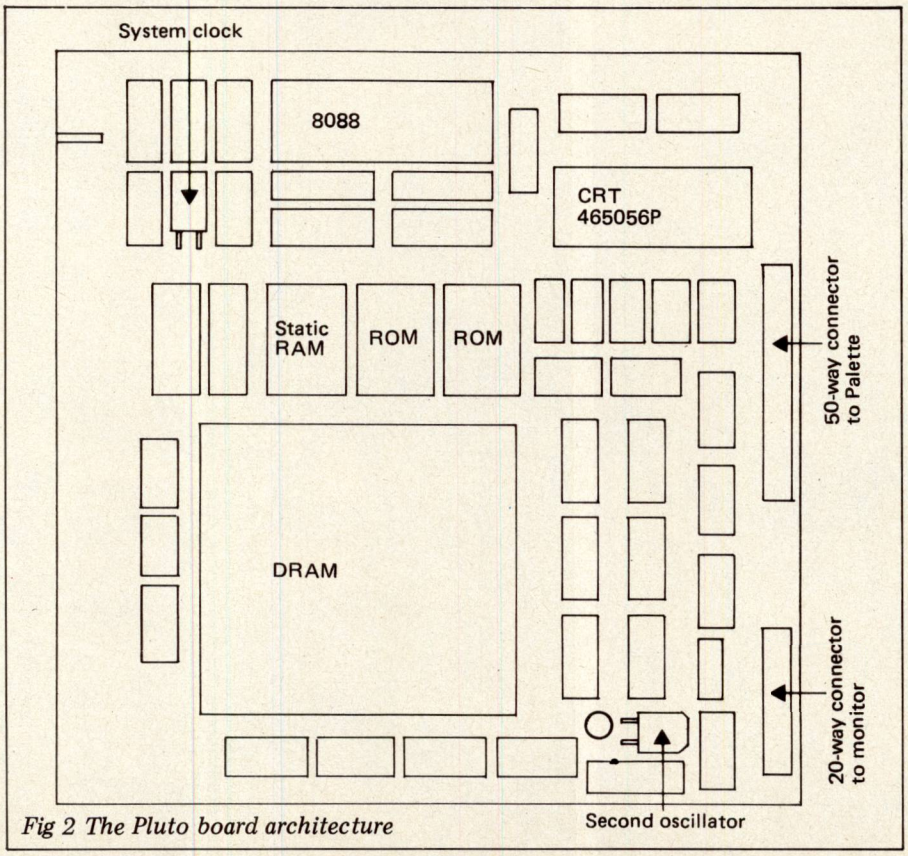



*Fig 2 The Pluto board architecture*

The commands for reading the colour value of a pixel are again divided into two and four-byte versions. There are fairly standard commands for colour definition, FCOL, CCOL, BCOL and TCOL. These stand for foreground colour, current colour, background colour and transparent colour respectively. The uses of these commands will be explained in more detail later.

There is a very powerful command for the manipulation of the above commands called 'STYLE'. This, in the simple graphics operations such as draw or plot, decides the method of laying the line, such that you AND, OR, XOR or REPLACE the line in memory: these are fairly standard functions, but none the less necessary. However 'STYLE' allows for various effects to be performed on other operations. The most useful of these 'other operations' is the ability to copy areas of rectangular memory (called Rasters). There are a number of Raster Ops which can be performed such as:

1) Set each pixel in the raster to a

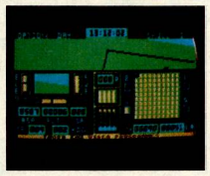
# "We will be flying at a height of 30,000 feet. Our air speed will be 500 knots. And there's a fair chance we're going to crash."





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# PLUTO POWER!

particular colour; used to fill areas of screen with a colour or to clear the screen. This is a standard command called RECTFILL.

2) Copy one raster to another. This is the way Pluto draws characters on the screen, and scrolling must be done by copying one character raster to another raster any number of lines up or down the screen (giving fast or smooth scroll). These functions are done using the COPY command.

3) Invert (complement) the colour of each pixel within the raster — useful for inverting characters on the screen.

4) Copies one raster to another, but at the same time uses another raster to mask the pixels as they are copied, giving the masked pixels in the destination raster one of two colours. This is used for displaying the text, where the character definition is in the mask raster. Those bits set in the mask are set to FCOL in the destination and the remainder set to BCOL (the Pluto's character set is defined using one bit per pixel giving only two colours). Any of the colours can be accessed by use of the STYLE command. However, if desired, the characters can be defined by the user using three bits per pixel giving a character containing all possible eight colours.

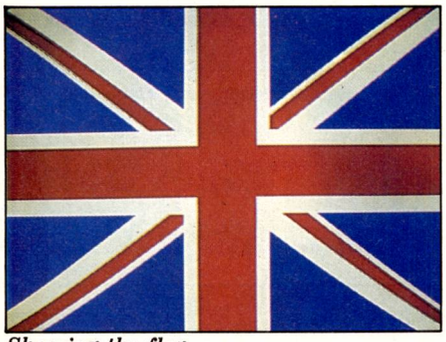
5) Paint to a raster using a mask raster which defines the colour of the pixels to be changed, while any other pixels are left unchanged. This is where the TCOL function is used, as the transparent colour is the one which is filtered out during the copy.

The above functions are achieved mainly using the COPY command. This one command requires no less than 14 data bytes to follow it; these include the partition identifiers and conditions for the destination and source rasters.

When using the card for writing text to the screen a number of options are available. Apart from those mentioned above for the alteration of colour and the copying of characters, the size of the actual symbol can be altered by defining your own character set. The size of the character depends only on your patience and the amount of free memory.

There is also a command for the filling in of large or small areas of memory. This is a COMPLEX POLYFILL function which flood-fills the area of memory specified up to a boundary which is assumed to be any colour other than that

*GOTO page 201*



*Showing the flag*

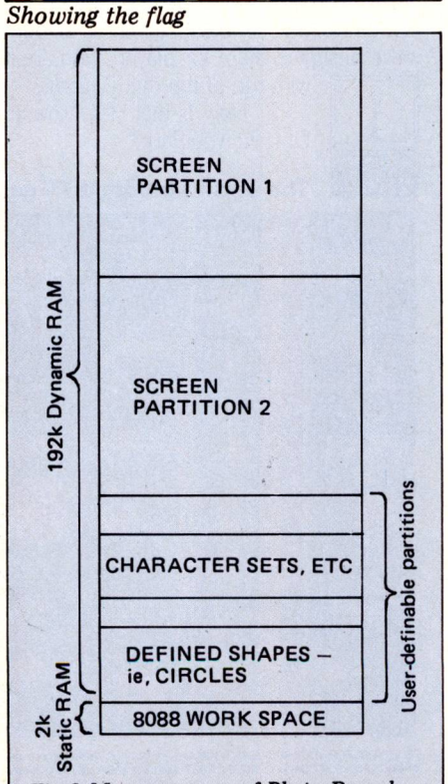
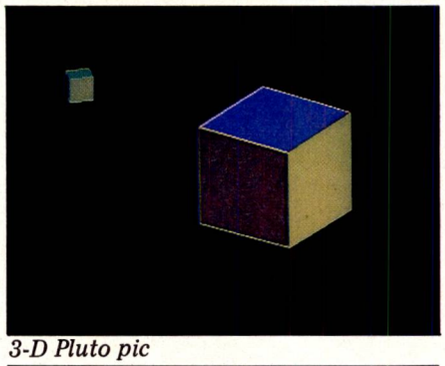



*Fig 3 Memory map of Pluto Board*

| COMMAND (sent as 1 byte) | NUMBER OF PARAMETERS sent | received | OPERATION |
|---|---|---|---|
| CopySymbol | 0 | 0 | Prints symbol |
| Allocate partition | 5 | 0 | Sets number & size |
| Copy | 14 | 0 | Block copy function |
| CopyToSymbol | 1 | 0 | From block to symbol |
| Initialise | 0 | 0 | Set parameters |
| InquireBCOL | 0 | 1 | Get background colour |
| InquireCCOL | 0 | 1 | Get current colour |
| InquireCP | 0 | 4 | Get cursor position |
| InquireCDP | 0 | 1 | Returns num of screen partition being displayed |
| InquireSCP | 0 | 1 | Returns symbol table number |
| InquireCWP | 0 | 1 | Returns no of screen partition not displayed (current working partition) |
| InquireFCOL | 0 | 1 | Returns foreground colour |
| InquireSTATUS | 0 | 1 | Is Pluto ready? |
| InquireSTYLE | 0 | 1 | See review |
| InquireTCOL | 0 | 1 | Returns transparent colour |
| InquireWPROT | 0 | 1 | No of mask write-protected |
| LineRel | 4 | 0 | Draw line relative |
| LineRelShort | 2 | 0 | |
| LineTo | 4 | 0 | Draw line absolute |
| LoadMemory | 4,* | 0 | Copy area of memory |
| LoadSymbol | 1,* | 0 | Defines a symbol number & shape. All defining bytes are sent after command |
| MoveRel | 4 | 0 | Changes CP |
| MoveRelShort | 2 | 0 | |
| MoveTo | 4 | 0 | Changes abs |
| PlotAt | 4 | 0 | Plots point at X,Y |
| PlotRel | 4 | 0 | |
| PlotRelShort | 2 | 0 | |
| Polyfill | 0 | 0 | Fills area of memory |
| ReadMemory | 4 | * | Outputs the byte contents of an area of specified memory |
| ReadPixel | 4 | 1 | Gets colour of pixel at point specified |
| ReadPixelRel | 4 | 1 | |
| ReadPixelRelShort | 2 | 0 | |
| ReadSymbol | 1 | * | Outputs bytes which define character |
| Rectfill | 4 | 0 | Fills a rectangular area of memory with colour specified by CCOL and STYLE |
| SetBCOL | 1 | 0 | Sets background colour |
| SetCCOL | 1 | 0 | Sets current colour for line-drawing, etc |
| SetFCOL | 1 | 0 | Sets foreground colour |
| SetCDP | 1 | 0 | (1 or 2) to define current display partition |
| SetCSP | 1 | 0 | Defines the partition which contains the characters in use |
| SetCWP | 1 | 0 | Defines the partition which is being worked on |
| SetStyle | 1 | 0 | Defines the function of this multi-purpose operation |
| SetTCOL | 1 | 0 | Defines the colour of the transparent mask used in COPY |
| SetWPROT | 1 | 0 | Allows for definition of a write-protected mask on any colour during a COPY operation |

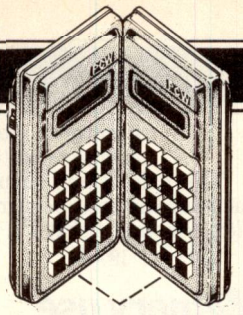
(*: the number of bytes depends on the amount of data required)
Other commands will be available with the new 8k version of the ROM

*Fig 4 Commands available with present Pluto ROM*



*3-D Pluto pic*

# PC-1211 COMPLEX ARITHMETIC



**The new HP-15C, reviewed in this column in September, has built-in complex number arithmetic — probably for the first time on a programmable. It is quite possible, however, to program this feature on most machines, and the following is a particularly nice implementation for the Sharp PC1211 by John Kerr of Glasgow.**
*Dick Pountain*

This program converts the 1211 into a calculator operating on complex numbers. It is run in the DEF mode. 'shft Z' creates storage space for up to 18 complex variables, labelled 'A' through 'R'. The assignment statements allowed have the general form

variable name (A. . . R) shft = operand enter operator enter
operand enter operator enter
:  :  :  :
operand enter enter

Operands are of two types. A type 1 operand is a variable name, which may be preceded by either or both of the monadic operators '—' and 'C'. These denote complex negation and conjugate respectively; eg, '—CF' represents minus the conjugate of F. A type 2 operand is a numerical input. Examples: 3—j4 is entered as '3 shft J—4'; 5 $\angle -53^{o}$ is entered as '5 shft K—53' (although the latter assumes DEGREE mode, the program will operate in any angle mode). Legal dyadic operators are '+', '—', '*', '/' and '^'. The first four of these represent complex addition, subtraction, multiplication and division. The fifth raises a complex number to a real power; it is followed by a special type of operand (a REAL operand), which is any arithmetic expression. Dyadic operators all have equal priority, and evaluation proceeds from left to right (there is no bracketing facility). Monadic operators have a higher priority and must not be followed by 'enter'.

Several types of prompt are used. These are:

> Begin entry of calculation
\# For entry of an operand
? For entry of an operator, or final 'enter'
J Rectangular notation; entry of second component
< Polar notation; entry of second component

The calculation buffer has 32 stages. Type 1 operands and REAL operands occupy one stage; type 2 operands require two, as does the final operand in a calculation, regardless of its type. If the calculation is not terminated (by final 'enter') before this buffer is saturated, the computer automatically suspends input and calculates and displays an intermediate result. To continue the calculation, press 'enter' then input the next operator symbol. This continuation is also permitted when the partial result has been ordered manually.

Memory recall uses the defined program 'L' (for 'look'). For example, 'F shft L' brings the content of memory F to the display. Results are always expressed in rectangular notation, but a result displayed by a memory recall or assignment statement can be converted to polar form by 'shft SPC' (the internal representation of the number is unchanged by this operation). Press 'enter' to return to rectangular form.

Program 'L' also provides the effect of *assignment operators* as found in Algol: 'F shft L enter / enter G enter enter' performs the assignment F=F/G and, in general, 'F shft L enter' is equivalent to 'F shft = F enter'.

Any of the 18 labels A. . . R may be used in the ordinary way, during calculations, to store REAL numbers. The corresponding complex space will no longer be accessible by its label, but its numerical pointer can be used instead; these pointers are 27 for A, 29 for B, etc. Thus '37 shft L', for example, will bring the value of complex memory F to the display. The calculation register (memories X and Y) is referred to by pointer value 24. On the LHS of an assignment statement it is used to display a calculation result without a destination; while on the RHS it can be used as any other type 1 operand, and has the interpretation 'result so far' — eg, used after '* enter', it squares the current value in the calculation register. NB: memory C should not be used for REAL storage as the operation of complex conjugation would be lost.

Four operations involving REAL storage are:

| | |
|---|---|
| Assign the real part of F to R: | R=A(F) enter |
| Assign the imaginary part to Q: | Q=A(F+1) enter |
| Assign the modulus of F to M: | F shft L shft SPC<br>M = U enter |
| Assign the argument of F to A: | A = V enter |

## Lexicon

| | | |
|---|---|---|
| Variable names: | | A, B, C, . . . R<br>27, 29, 31, . . . 61 |
| Complex assignment symbol: | | shft = |
| (Literals) | x + jy: | x shft J y |
| | r $\angle$ s: | 2 shft K s |
| (Other operands) | minus F: | —F |
| | conjugate of F: | CF |
| | — conjugate of F: | —CF |
| (Complex dyadic operators) | | |
| | plus: | + |
| | minus: | — |
| | times: | * |
| | divide: | / |
| | power: | ^ |
| Memory recall procedure: | | shft L |
| Rectangular to polar: | | shft SPC |
| Real part of F: | | A(F) |
| Imaginary part of F: | | A(F+1) |
| Modulus of F: | | U (after 'F shft L shft SPC') |
| Argument of F: | | V (after 'F shft L shft SPC') |

Evaluate the polynomial $P = A^4 + (2 + j3)A^3 - 4A^2 - (5+j6)A + 7—j8$, for the present value of A(—1—j8). The expression for P is rewritten in 'nested multiplication' form prior to entering the calculation, since the operators can then be obeyed in the order in which they appear:

P = (((A + 2 + j3)A — 4)A — (5 + j6))A + 7 — j8.

P shft = A enter + enter 2 shft J 3 enter * enter
A enter —enter 4 shft J 0 enter * enter

*Sample calculations*

| CODE ENTERED | COMMENTS | DISPLAY |
|---|---|---|
| (DEF mode) DEGREE enter shft Z | Sets angle mode & pointers | |
| A shft = —1 shft J —8 enter enter | Assignment: A = —1—j8 | —1 —8 |
| B shft = 10 shft K 45 enter enter | Assignment: B = 10 $\angle$ 45° | 7.07... 7.07... |
| C shft = A enter + enter B enter enter | The sum of A and B is stored in C | 6.07...—0.92... |
| D shft = A enter * enter B enter enter | Product in D | 49.49...—63.63... |
| E shft = A enter / enter B enter enter | This calculation assigns $\sqrt{(A/B+CD)}$ to E; note it has the form | —6.36...E—01<br>—6.36...E—01<br>—4.94...E—01 |
| E shft = C enter * D enter + enter E enter ^ enter ½ enter enter | temp = A/B:<br>E = (C*D+temp)$^{1/2}$ | 19.18...—11.28... |
| F shft = —CA enter + enter CC enter * enter 1 shft J 2 enter enter | $(-\overline{A} + \overline{C}) * (1+j2)$ where $\overline{A}$ = conjugate of A, etc, is assigned to F | 21.21...7.07... |

A enter −enter 5 shft J 6 enter * enter
A enter + enter 7 shft J −8 enter enter

This calculation occupies 12 stages of the buffer: one each for the four occurrences of 'A', and two for each complex constant ('shft J'). The correct answer is
P = 2847 − j493.

## Memory use

| | |
|---|---|
| A to R | Pointers to complex variables |
| S to Z | Program working space |
| A(27) to A(62) | Complex variables (storage area) |
| A(63) to A(126) | 32-stage calculation buffer |

Remaining memory is entirely filled by the 624 steps of program.

## Defined programs

| | |
|---|---|
| shft Z | Pointer initialisation routine |
| shft = | Used as assignment symbol, complex arithmetic |
| shft J | Numerical input, rectangular notation |
| shft K | Numerical input, polar notation |
| shft L | Data recall |
| shft SPC | Rectangular to polar conversion |

NB: Program length is critical; add so much as one colon after a label and it will not work at all. Any addition to the program (such as making the 'complex calculator' programmable) will entail a reduction in the size of the calculation buffer (reduce 'T=126' at lines 80 and 6). Conversely, T can be increased by two (and the buffer by one stage) for every group of 16 program steps deleted.

*John Kerr*

```
 1: "+" U=-U: V=-V
 2: "-" X=X-U: Y=Y-V: RETURN
 3: "*" S=1: GOTO 5
 4: "/" V=-V: S=UU+VV: IF S=Ø BEEP 2: PRINT "DIV. BY ZERØ": END
 5: T=UY+VX: X=(UX-VY)/S: Y=T/S: RETURN

 6: "=" AREAD Z: S=64: T=126: INPUT "#", A(S): GOTO 1Ø
 7: "J" AREAD A(T-1): INPUT "J"; A(T): GOTO 9
 8: "K" AREAD U: INPUT "<"; V: A(T-1)=U*COS V: A(T)=U*SIN V
 9: A(S)=T-1: T=T-2
1Ø: S=S+2: IF S<T INPUT A$(S-1), "#", A(S): GOTO 1Ø

2Ø: X=Ø: Y=Ø
3Ø: FOR W=63 TO S-3 STEP 2: IF A$(W)="^" THEN 9Ø
4Ø:   V=A(W+1): S=SGN (2ØØ-ABS V): IF -S LET V=V/C
5Ø:   U=A(ABS V)*SGN V: V=A(ABS V+1)S*SGN V: GOSUB A$(W)
6Ø: NEXT W
7Ø: A(Z)=X: A(Z+1)=Y: BEEP 1

8Ø: "L" AREAD Z: PRINT A(Z), A(Z+1): S=64: T=126: A(S)=Z: GOTO 1Ø

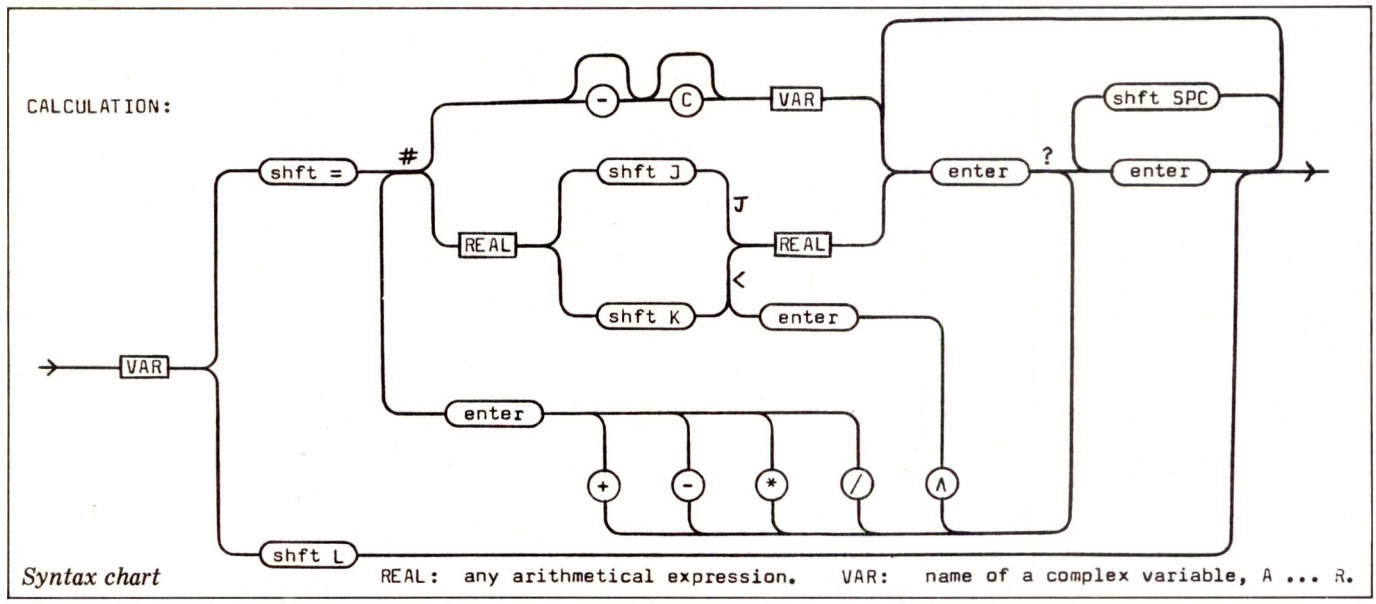
9Ø: GOSUB 1ØØ: T=A(W+1): U=UAT: X=U*COS TV: Y=U*SIN TV: GOTO 6Ø

1ØØ: U=√(XX+YY): IF X=Ø LET V=ASN SGN Y: RETURN
11Ø: V=ATN (Y/X): IF -X LET V=V+(SGN Y+(Y=Ø))*ACS -1
12Ø: RETURN

15Ø: " " X=A(Z): Y=A(Z+1): GOSUB 1ØØ: PRINT U, V: GOTO 8Ø

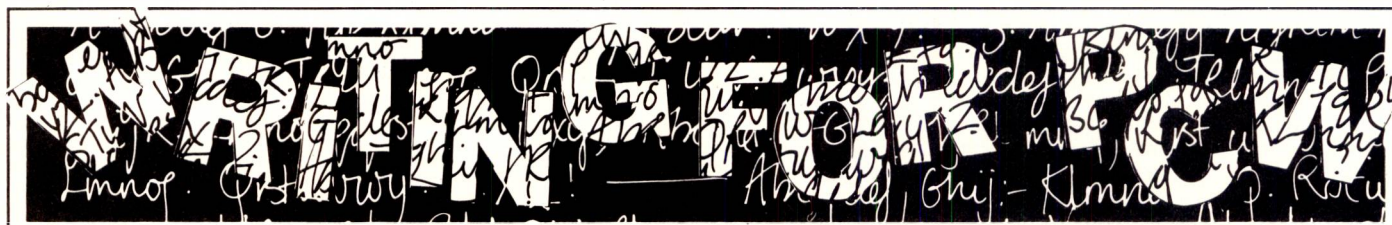
2ØØ: "Z" FOR W=1 TO 18: A(W)=25+2W: NEXT W: A$(63)="+": BEEP 2: END
```

*Listing*




*Syntax chart*

REAL: any arithmetical expression. VAR: name of a complex variable, A ... R.




*PCW* welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and 'phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime 'phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the lookout for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading *PCW* will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — *PCW* does pay for all published work.

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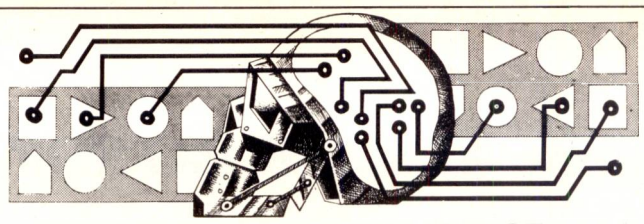
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ARTIFICIAL INTELLIGENCE

# INTELLIGENCE TESTS FOR COMPUTERS?

*Bev Mason explains how computers can tackle a standard intelligence test by using the calculus of finite differences*

We are all familiar with the tests used to gauge intelligence, particularly with children, where the subject is asked, among other things, to deduce the next term in a sequence of numbers. For example, the given sequence might be 1, 4,9,16, — or 3,5,8,12,—. In the first case the series is obviously a sequence of ascending squares, the next term being 25. In the second case, it is easily seen that the difference between successive terms increases by one at each step, and the next term is 17.

A less obvious sequence is —1,1,19, 65,—, where the next term is 151. Even when the answer, the next term, is known the relationship is by no means obvious. In this case, each term is derived by subtracting four times the square of the term *position* from twice the cube of the position and adding one, ie, the *third* term is equal to 2*3*3*3 — 4*3*3+1=19.

It is interesting to pose the question 'Can a computer be programmed to do these intelligence tests?' When one considers the virtual infinity of relationships which can exist between successive terms of a sequence it would seem that the answer must be in the negative. How can one disassemble the mental processes involved in the 'casting around' for a possible relationship, in order to write a program? Also, if a computer can be programmed to accomplish these tests when computers are undeniably *not* intelligent, do the tests really warrant the name 'intelligence tests'?

Before delving further into these questions, let us say at the outset that a computer *can* be programmed to derive the next term in a sequence, or indeed the nth term, forward or backward, and also display the relationship between the terms. The short program at the end of this discussion does just these things. We shall see some further anomalies!

## A simple sequence

Let us suppose a child is given the first sequence above, ie, 1,4,9,— and is asked to write in the next term. This looks like, and is, a sequence of squares, the next term being 16. So when the child puts a 10 on his paper he gets no marks and is considered to be little better than an idiot — perhaps unjustly, as we shall see.

It is necessary to examine the question more closely. We have become so familiar with this type of test that usually only the minimum is stated. Much has to be inferred or 'understood'.

The fact that the next term in a sequence of terms is requested indicates a count. What is really being stated is

y= 1 4 9
n= 1 2 3 4 5

and it is obvious that $y=n^2$ and the term for n=4 is 16; that for n=5 being 25 and so on. We could have been asked to fill in the *preceding* terms — ie, those corresponding to 0,—1,—2,etc.

y= 4 1 0 1 4 9
n= -2 -1 0 1 2 3

The series extends to infinity both ways and the relationship $y=n^2$ holds true. However, n is nothing more than a count, simply marking the position of each term and there is nothing in the original question regarding the starting point of the count. In the above example y has a minimum value of 0 and it is convenient to zero the count at that point. Had the given terms been stated as 9,16,25,—, we could have written

y= 9 16 25 — —
n= 1 2 3 4 5

The next terms would still be 36 and 49 but y would certainly not equal $n^2$. Common sense, or 'intelligence' would have told us to start the count with n=3 rather than n=1. But suppose that the given sequence had been a series of numbers with no immediately recognisable relationship. The zero point, in the absence of any guidance, would have to be positioned arbitrarily. Let us start a new count 'p' one position further along:

y=1 4 9 —
n=1 2 3 4
p=0 1 2 3

Now n=p + 1. We can see that $y=n^2$ therefore $y = (p+1)^2$, which simplifies into $y=1+2p+p^2$. This is not as immediately obvious as $y=n^2$ but is just as valid. When p=3, y=16, which comes as no surprise.

The child in our example, far from being an idiot, is in fact a genius of rare talent. He had spotted that the relationship between y and p is not only by $y = 1+2p+p^2$ but also by $y = 1+4p^2 — p^3$. In the first case the term for p=3 would be 16 while in the second case it would be 10. In the absence of any guidance from the question he plumped for the 'cleverer' answer and wrote '10'. Had the question sought the preceding term, the child would have written 6 and not 0.

It would seem then that not only can this type of intelligence test be correctly answered by an unintelligent computer, but it can also give a damaging and misleading assessment of a child's intelligence. Perhaps it would be more meaningful if, in addition to requesting the next term, the relationship used in arriving at that term should also be stated.

Before leaving this brilliant, misjudged and probably unbearable child let us not utterly condemn this intelligence test. The computer arrives at the answer by mathematical (arithmetic) means which can, as will be shown, be achieved by humans fairly simply with pencil and paper but not without (except in the easiest or trivial cases). Instead the human uses intuitive mental processes which are undoubtedly facets of intelligence which can be tested.

We shall see, with the aid of our program, that it does not matter in practice where the count is started, whether we count in ones, twos or twenty-threes, or whether the given sequence is three numbers or ten numbers long. It does not even matter if those numbers are generated randomly by our computer! We can still find a relationship between them and state the next (or for that matter the next but sixteenth) number in the sequence.

## The 'other' calculus

All of the above is by way of being a lead into a small facet of a fascinating branch of mathematics known as the calculus of finite differences. (The non-mathematical reader need not worry. The remainder of the discussion contains only arithmetic and very elementary algebra.)

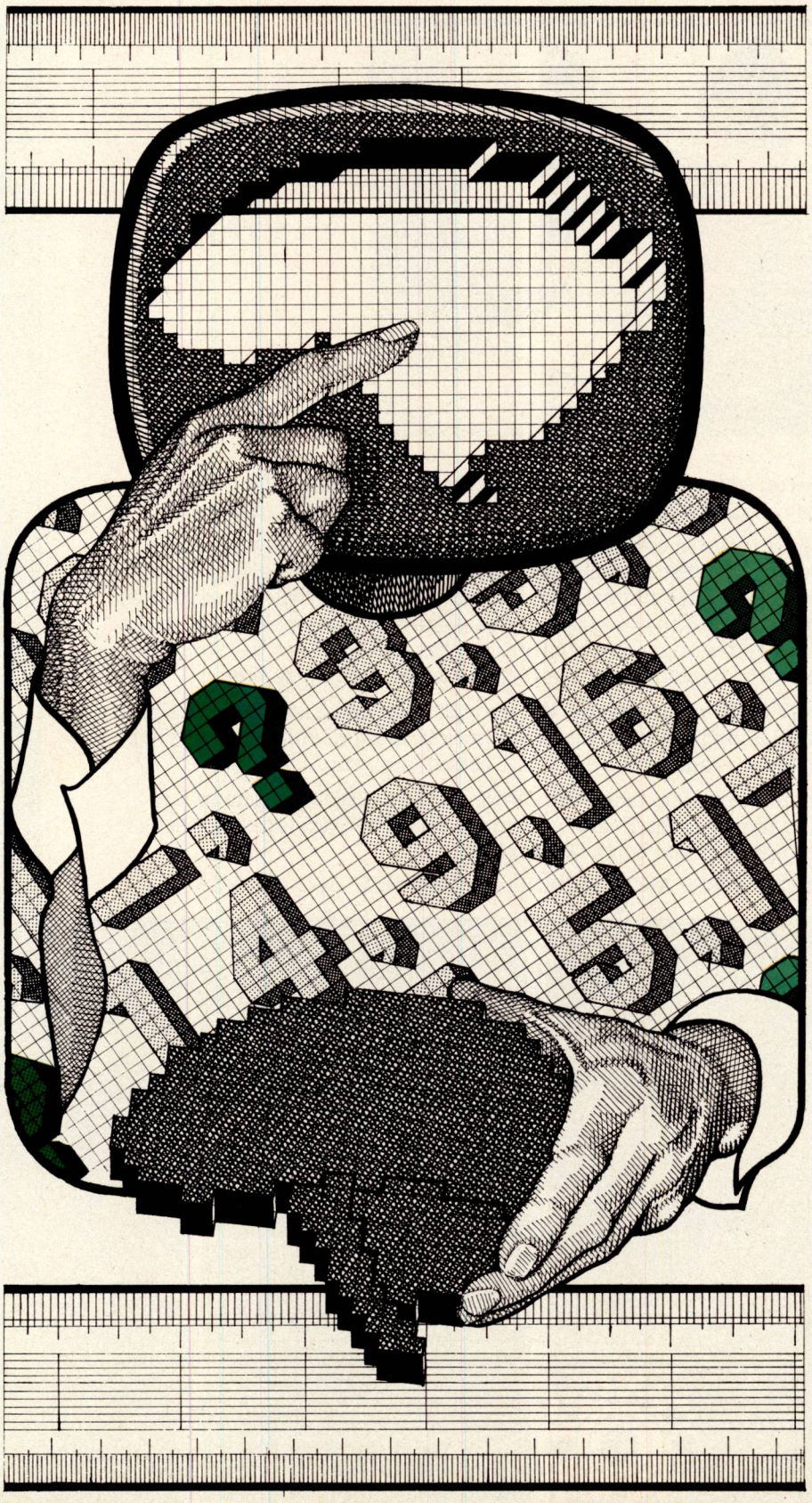
The more usual infinitesimal calculus deals with relationships between *continuously varying* quantities. It assumes that one variable changes by an infinitesimal amount and studies the effect on related variables. An elementary application is in the calculation of maxima and minima. Thus, given a relationship such as y=81/8x+x/2, it can be shown that y will be at its lowest value when x=4.5. However, if y represents the number of hours needed for a

job to be done by x men, this method is of no great value. We cannot employ 4.5 men and there is no indication whether 4 men would be more economical than 5. Since we cannot have fractional men, nor negative men, their number x cannot be continuously variable and the methods of the infinitesimal calculus are not strictly applicable. Hence the calculus of finite differences.

## Finite differences

In the 'normal' calculus briefly described above, the variable x is assumed to change by an infinitesimal amount Dx to a value (x +Dx). By subtracting the initial value x from the increased value (x+Dx) we obtain the infinitesimal difference Dx. Since y depends on x it also will change, from y to (y+Dy), and by taking the difference we can arrive at Dy. The calculus then studies the relationship between Dx and Dy or the ratio Dx/Dy, a process known as differentiation. In the same way that the process was applied to x and y, it can be applied to the quantities Dx and Dy and to successive differences: the process is then known as successive differentiation.

When x can assume only integer values the difference between one value and the next can only be finite, and is invariably taken to be unity. The difference in x is therefore 1 and the corresponding difference in y is designated by the Greek capital letter Delta. We shall use the letter D. The process is known as differencing and, if continued, becomes successive differencing.



## A series of cubes

By way of an example, consider the sequence of cubes:-

| | | | | | |
|---|---|---|---|---|---|
| y = | 0 | 1 | 8 | 27 | 64 |
| x = | 0 | 1 | 2 | 3 | 4 |

To start the process of differencing, set the work out in tabular form:

| x | y | D | $D^2$ | $D^3$ | $D^4$ |
|---|---|---|---|---|---|
| 0 | 0 | | | | |
| | | 1 | | | |
| 1 | 1 | | 6 | | |
| | | 7 | | 6 | |
| 2 | 8 | | 12 | | 0 |
| | | 19 | | 6 | |
| 3 | 27 | | 18 | | |
| | | 37 | | | |
| 4 | 64 | | | | |

The column headed D is obtained by subtracting each value of y from the next higher value. In a similar way, the column headed $D^2$ (second difference, *not* D*D) is obtained from the D values, and so on. The relationship between x and y is then given by the top figures in each column starting with the y column:

$y = 0 + 1D + 6D^2 + 6D^3$ (A)

where

$D = x/1$,

$D^2 = x(x-1)/(1*2)$,

$D^3 = x(x-1)(x-2)/(1*2*3)$,

$D^n = x(x-1)(x-2)$ --- $(x-(n-1))/(1*2*3$ -----$*n)$.

Substituting these D values in equation (A) we get

$y = x + 3x(x-1)+x(x-1)(x-2)$ (B)

By substituting in this equation values of x=0 to 4 the original values of y are obtained, as are also those for x=5 (y=125), and for x = −2 (y= −8), etc. We know of course that in this example the equation (B) reduces to $y=x^3$.

The theory requires only that x should vary in equal steps. However, differencing is done on the basis that the independent variable varies by unit steps starting at zero. If x does not start at zero, or if it increases or decreases by equal amounts other than unity, it is necessary to introduce a further variable, say p, which does fulfill the necessary conditions. It is a simple matter to establish the relationship between x and p, eg:

| | | | | |
|---|---|---|---|---|
| y | 5 | 7 | 12 | 21 |
| x | 13 | 20 | 27 | 34 |
| p | 0 | 1 | 2 | 3 |

y will be obtained as a function of p:

$y = f(p)$ (C)

where p=(x−13)/7. If the value of y is sought for (say) x=15 it is only necessary to calculate the value p=2/7 and substitute in equation (C).

## But what use is it?

Suppose we have obtained experimentally a series of values of y in relation to values of x. If the values of x vary in equal steps we can use the method outlined above to forecast values of y for other values of x. If the values of x are not equally spaced we can plot the points, join them with a smooth curve,

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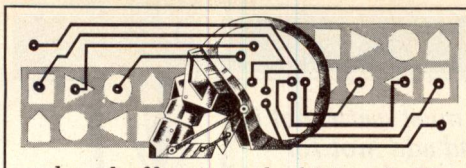


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and read off y at standard intervals. The method will then forecast or extrapolate *possible* y values outside the graph. But remember, we get only a forecast, not a certainty.

Suppose our first four results were 0, 1,8 and 27 as in the cube series above. If these were RUN in the program, the computer would correctly forecast 64 and 125 for x=4 and 5 respectively and print the relationship as $y=x^3$. However, suppose the value of y for x=4 were subsequently determined experimentally as 40 and not 64. On feeding the computer the sequence 0,1,8,27,40 it will reply correctly with y=5 for x=5 instead of y=125. The relationship will now be printed as $y=6x-11x^2+7x^3-x^4$. It can easily be seen that the sequence 0,1,8,27 can be followed by an infinity of different numbers of which 64 and 40 are but two.

Our child (I thought we had lost him) could have put any number he liked, positive or negative, after the sequence in his intelligence test, and proved that it was logically related to the earlier numbers.

In the 'conventional' calculus, the opposite operation to differentiation is integration. One method of finding the integral of a mathematical expression is to plot the graph of the equation and measure, or calculate, the area between the curve and the x axis; Simpson's Rule is a method for calculating irregular areas. It is applied by dividing the area into equally spaced strips, measuring or calculating the length of each strip, and applying a simple formula. It can be programmed into home computers to perform the function of integration. The division of the area into finite steps or strips suggests the calculus of finite differences, and in fact Simpson's Rule and similar methods are derived from that calculus. However, the derivation of Simpson's Rule is too complex to be described here, but its application in computers to calculate definite integrals is simple.

The universe operates in a continuous and smooth fashion — eg, time and planetary motion — and the infinitesimal calculus has been universally applied. However, there are those who maintain that the calculus of finite differences offers a more practical picture since the world operates in a digital manner: a view which should be popular with computer people who can more easily appreciate things operating a 'bit' at a time. It is obvious that the number of men needed to do a job, or the number of bricks required to build a house, must be integers. It is perhaps not so obvious that the 'smooth' speed of a car is related to the integer number of engine firing strokes per second: one cannot have a fraction of an explosion. Even the classic problem of water running into and out of a bath could be stated in terms of whole numbers of molecules.

## When is a random number not?

When I asked my computer to generate four random numbers between 1 and 20 it replied with 8,2,5,17. I set them as a series:

y = 8 2 5 17
x = 0 1 2 3

and fed them into the program. The computer showed that the numbers are related to the expression $y = 8-10.5x + 4.5x^2$ and that the next number in the 'series' would be 38!

## The program

The program is written in Microsoft Basic for use with the Z80 based Video-Genie computer. It occupies about 1.2k of memory, which could be reduced considerably by compression. In the absence of DIMension statements the size of the arrays D(N), E(N), X(N), Y(N) is automatically set to 10 and that of the array C(N,M) to 10*10. The program will therefore accept a sequence of up to ten numbers, as printed, and will require a further 0.8k of memory to RUN. This requirement can be reduced considerably by restricting the sizes of the sequence and of the arrays by including correspondingly suitable DIMension statements.

```
10  INPUT "HOW MANY VALUES ARE KNOWN":V1:V=V1-1
20  INPUT "LOWEST VALUE OF X"; X(0)
30  INPUT "CORRESPONDING VALUE OF Y"; Y(0)
40  FOR N = 1 to V
50  INPUT "NEXT VALUE OF X"; X(N)
60  INPUT "NEXT VALUE OF Y"; Y(N): NEXT N
70  INPUT "FOR WHICH VALUE OF X IS Y REQUIRED"; X
80  DX = X(1) - X(0)
90  IF X(V) <>X(0) + V*DX PRINT "INCORRECT DATA": GOTO 10
100 IF X - INT(X)<>0 PRINT "INCORRECT DATA": GOTO 10
120 D(0) = Y(0): N = 1
130 IF N = V + 1 GOTO 180
140 FOR N1 = 0 TO V - N
150 Y(N1) = Y(N1 + 1) - Y(N1): NEXT N1
160 D(N) = Y(0)
170 N = N + 1: GOTO 130
180 P = (X - X(0))/DX
210 Y = D(0)
220 N2 = 1
230 Q = 1
240 FOR N1 = 1 TO V
250 N2 = N2*N1
260 Q = Q*(P - N1 + 1)
270 Y = Y + D(N1)*Q/N2: NEXT N1
280 CLS: PRINT:PRINT:PRINT:PRINT "WHEN X="X"Y="Y
290 REM 'EVALUATE ALGEBRAIC RELATIONSHIP'
300 C(1,0) = 0: C(1,1) = 1
310 FOR N = 1 TO V
320 C(N,N+1) = 0: NEXT N
330 FOR N = 2 TO V
340 FOR R = 1 TO N
350 C(N,R) = C(N - 1,R - 1) - (N - 1)*C(N - 1,R)
360 NEXT R: NEXT N
370 N2 = 1: E(0) = D(0)
380 FOR N = 1 TO V
390 N3 = N2
400 FOR N1 = N TO V
410 E(N) = E(N) + D(N1)*C(N1,N)/N3
420 N3 = N3*(N1 + 1): NEXT N1
430 N2 = N2*(N + 1): NEXT N
440 PRINT "Y = ";
450 IF E(0) = 0 GOTO 470
460 PRINT E(0);
470 IF E (1)<0 GOTO 500
480 IF E(1) = 0 GOTO 510
490 PRINT "+" E(1) "P";: GOTO 510
500 PRINT E(1) "P";: GOTO 510
510 FOR N = 2 TO V
520 IF E(N)<0 GOTO 550
530 IF E(N) = 0 GOTO 560
540 PRINT "+" E(N) "P["N;: GOTO 560
550 PRINT E(N) "P[" N;
560 NEXT N
570 PRINT:PRINT:PRINT "WHERE P =(X-" X(0)")/"DX
```

*Listing*

Lines 10-70 are self-explanatory
Line 80 determines the interval of finite differences between the x values.
Lines 120-170 calculate the differences between the successive y values, setting the differences as a new series of y values and repeating the process. The intial values of y and of the successive difference series are set into the array D(O) — D(N).
Line 180 establishes where x falls on the p scale, zero p falling on the first y value.
Lines 210-270 evaluate the successive terms of the relationship y=f(x) and add them together to give the value of y.

As described above, the program deduces and evaluates expressions such as: $y=x+6x(x-1)/1*2)+6x(x-1)(x-2)/(1*2*3)$

This expression is equivalent to the much more convenient and understandable form $y=x^3$. In writing a program to convert from one form to the other it is necessary to overcome the computer's inbuilt tendency to substitute numerical values for algebraic symbols. After all, the computer was designed to do arithmetic and not algebra.

Lines 300-560 are therefore a rather tedious way of reducing the first untidy algebraic forms into ascending power forms, and printing the result. If preferred, these lines could be replaced with a very much shorter version to print the relationship in the original untidy form. Note that Video-Genie language P[3 means P cubed. END

# COMMUNICATIONS

*PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications', Personal Computer World, 62 Oxford Street, London W1A 2HG*

## Those factors again

In your May edition, a Mr Hunter asked how he might factor a large number. This drew a 'number' of well-meant but ill-informed replies to the effect that if (as suspected) Mr Hunter was looking for prime factors, it could take him about $10^8$ years.

In fact, recent progress in the application of number theory has increased the rate of testing for primality by a 'factor' of $10^7$. The products of 100-digit primes are no longer thought secure for encryption purposes.

Mr Hunter should contact Dr H W Lenstra (University of Amsterdam, tel 020-5259111), or even design his own method, based on the techniques described on p28 of *ZX Computing* Vol1 No 2, 1982.

Dr David Fisher, Cardiff

## Fix wanted

I would be obliged if you could publish this letter as I am at present unable to obtain any advice locally. I have with me an Osborne 1 and Epson MX80 FT III which I consider to be excellent value for money. However I find that the 'Install' program is unable to make the best of configuring for my printer as Wordstar expects toggles where the Epson has separate control codes for turning on and off certain modes. Does anyone know how to Install for the Epson? Also, as an instructor in electronics I have to produce inserted graphs of sine waves, etc, in my notes. I have a Basic routine that prints them but it is *very* slow and cannot be patched to Wordstar . . . any ideas? I have a similar problem with calls in Basic as I don't know the best way to pass variables to the subroutine. What it is to be ignorant!!

It may not be commonly known that location 61281 contains the horizontal screen position during scroll and location 61282 the vertical screen position. It is necessary to divide the horizontal by 2, and there are offsets, but they allow a fantastic 3D space simulation with centralised aiming sights for those who like games. It is also much easier to poke direct to the screen RAM as per other machines than to use the Osborne routine. Screen memory starts at 61440 as top left of normal screen. (A Basic listing is enclosed . . . rough and ready but gives a guide.)

Perhaps there is a users club in the UK who can find someone to act as a 'pen-pal' or should I say keyboard-pal, as that is what I need here. I will be here for quite a while longer so the address above will hold good until Christmas at least.

Richard C. Ferryman, 208 Airport Hotel, P.O. Box 2012, Jeddah, Saudi Arabia

*You are certainly not the only one with this Osborne/Epson problem Mr Ferryman. The fix is too involved to explain here, however it is documented in issue 1 and 2 of 'Portable Companion', the magazine put out by Osborne for its users. The first issue is free to all Osborne users, and subscriptions are available; Osborne UK will be sending you the relevant issues gratis — Ed'll Fix It.*

## Dots or brackets...

In response to your challenge (October 1982), I'd like to suggest a way of listing lists of lists of lists for Lisp without brackets. Logicians began using 'Dot Notation' before the inception of set theory. A century on, they are still ranting, enthusing and raving about how convenient and manageable this has turned out to be, and how clever they were to have thought of it.

Let's jump in at the profound end, with Mr Liardet's first example of Lisp data. Using dot notation, it looks something like this:

```
(SETQ PEOPLE ': BASIL
32 M . CYNTHIA 30 F
JOHN 28 M)
```

Here, the colon has the job of delimiting the scope of the quote mark — but see how clearly it divides the list assignment into destination and source. Whereas the action of the brackets is to bind elements together, dots act as element *separators*. They can be compared to ordinary prioritised infix operators: the more dots in a group, the lower the 'priority' of the separator, and the greater its scope (the size of chunk it governs in the list).

For a somewhat dramatic illustration, consider next the definition of the function LENGTH:

```
(DE LENGTH . LIST :
COND : : EQ LIST NIL . 0
       : : T :. PLUS 1 :
LENGTH . CDR LIST)
```

If you don't think that makes the list structure a lot clearer, did you notice the printer's error in the original? There's an erroneous right parenthesis on the end of the second line.

Now to those lists of lists of lists. The simplest I can think of is a pair of pairs of pairs of atoms. Take your pick — brackets or dots?

```
(SETQ PAIRS '(((A B)(C D))
((E F)(G H))))
(SETQ PAIRS ':.A B . C D :
E F . G H)
```

John Kerr, Glasgow

## ...Lisp or logo

Referring to Mr Kerr's letter suggesting that a Lisp interpreter would run faster if reserved words were to be tokenised and brackets removed, it must be made clear that to the interpreter a program, ie, a list, is represented as a set of linked pointers. The brackets are used to delimit lists only in the input/output routines. In Lisp not only are the reserved words tokenised, all words are! If Mr Kerr desires the elegance of Lisp without so many brackets, then I suggest he considers Logo which is Lisp-based and is friendlier in use. This leads me to my second point.

Mr Parr's Logo compiler written in Basic is an interesting program (though lamentably slow) but contains a bug which could confuse a beginner grappling with recursion. If a previously encountered function is again recognised by the compiler, the number of arguments is not fetched and at run time the function is called with wrong values. This occurs in the Branch program in the June 1982 Logo article. It can be fixed by changing line 9730 to read.

```
IF SY$ =PN$(W) THEN
N=CP(N); RETURN
```

Ian A Stewart, Ealing

## Spectrum bugs

Spectrum owners beware! There are at least two ROM bugs in my Spectrum, and presumably all others.

LET A$="ab" + STR$ n + "cd" usually gives the correct answer — eg, ab 12.3cd, but if 1)n)o the ab prefix is lost eg, 0.12cd.

Pause after INKEY$ — generally the pause is reduced to zero, unless the pause is repeated (it works the second time).

Both these bugs can be irritating — and I would not be surprised if others crop up after I have used the computer more.

I have written to Sinclair about this, but have not (of course) received any reply.

G G R Rutter, Woking

*Thank you for your addition to the increasing number of Spectrum bugs, Mr Rutter. This machine certainly seems to have its share of idiosyncrasies — try hitting 'Caps Lock' or both shift keys together when the Spectrum gives a 'Scroll' prompt for a demonstration of one of the stranger bugs— Ed.*

## Safer downloading

Guy Kewney was right in his article 'Phone Foul-Up' in your October issue that transferring large amounts of data from one computer to another over the telephone lines 100 per cent correctly is a tricky business. There you are, having just transferred 12,000 characters down the line without the operator interrupting, only to find that the 1395th, the 6413th and the 11,999th are corrupted (except that you will never work up the energy to check them all — and doesn't that rather spoil the point anyway?).

That is why the Owl Micro-Communications telesoftware converter doesn't work that way! Prestel fortunately sends you one screen of data at a time. This is about 1000 characters. This is a reasonable number to expect to come down uncorrputed.

If it is corrupted, our program will notice because one of the characters will have a 'parity error'. We then use a useful Prestel command '*00' which asks for a repeat of the screen. Normally this repeat will be okay, but if necessary the program will try again and again until the screen arrives correctly.

We regularly bring down programs of 12,000 bytes reliably with our down-

loader in about five minutes. Perhaps Guy Kewney was using a 300 baud modem for it to take so long?

It seems to us that the CET telesoftware format (which our converter uses) is likely to be successful and appropriate for programs up to 20 kbytes in size, with someone watching the downloading to catch the very occasional snarl-up. For bigger programs or unattended operations, something more sophisticated is really needed.

As a final point, with all this interest in telesoftware, what about using the same system to transfer data? When will see see Visicalc data files on Prestel? There is no need for any technical changes, someone just needs to come along and use it.
Mike Gardner, Owl Micro-Communications Ltd, Sawbridgeworth, Herts

## Space defender

It is a shame that so much had to be left out of 'Brain Dump' in the October issue. In particular, I wish room could have been found to justify the dangerous use of a space as a mathematical symbol in GSB's arithmetic, since this can, as it does here, involve implicit axioms. It seems that the axioms should include (though one can't be sure):

space space = space
space = space
space = space
space = space
= space

which are isomorphic to

0 or 0 = 0
0 or 1 = 1
1 or 0 = 1
1 or 1 = 1
NOT 0 = 1
NOT 1 = 0

respectively.

If this is so then GSB's arithmetic is nothing more than Boolean algebra and can hardly be said to be more fundamental.

Your article tries to allay the suspicion that *Laws of Form* is a crank book, and to encourage potential readers, but I must regretfully say 'Not convinced'.
James Crrok, Cambridge

*This is one of several letters from mathematicians who disapprove quite strongly of Spencer-Brown's work. His proof of the four-colour theorem is by no means accepted 'in the trade', and is as far as I know not officially published. Not being a professional mathematician, I do not feel threatened by the unorthodoxy of* Laws of Form, *nor do I feel that* PCW *readers are likely to come to much harm.*

*It is indeed a shame that so much had to be left out; I obviously failed to make clear that 'space' is not a symbol, but precisely the space in which a cross stands. There is only one initial symbol, the cross, which indicates the marked state. The idea is certainly more fundamental than Boolean algebra, to the point where having to write it in ink on paper almost subverts its understanding. It may well be dangerous, but then so are flying and mountaineering. PS: Blackwells of Oxford have informed me that they are importing the book and it will be in stock soon —DP.*

## A use for VAL$

Dave Tebbutt, reviewing the Sinclair ZX Spectrum in the June 82 issue of *PCW*, could not think of a use for VAL$ — nor could I at the time.

It could be used if a *string expression* such as A$ AND Q=0 occurred frequently in a program. The prologue would include LET Q$= "A$ AND Q=0" and the body of the program could then use VAL$ Q$ whenever the expression was needed.
W E Thomson, Aldeburgh

## Would be user group?

How's this for a thought? One is aware of the countless thousands awaiting delivery of mail order microcomputers and the need perhaps for some kind of club, whereby recognition of our common plight is secured and where we can air over various experiences.

In the case of the elusive Spectrum I suggest the wearing of a large lapel badge with an updatable number indicating the elapse in weeks since ordering — surrounded by stick-on stars representing the weeks since Sinclair cashed one's money without delivering.

In my own case I will sport a number 20 and seven stars. By the way — is this a record?
H R McCartan, Bracknell.

*It might be. . . unless someone out there knows better? — Ed Rantzen*

## Dutch treat

Every Sunday evening, the Dutch radio transmits two computer programs in a sort of standardised Basic that can be understood by the operating system in most computers. The programs are sent in the listed form as purely ASCII characters, using 2400/1200 c/s as 1/0 indication, and transmitting 1200 bits per second. The time of the transmission is about 18.40 on MW 747 KHz.

I live five miles south of Copenhagen centre and have had success in receiving the programs and transferring them to my computer (ABC 80) during the last three Sundays. As the distance from me to the transmitting station is about 400 miles, which is more than the distance to London, I think that this information will be of interest to you and your readers. The programs are in no way only beginners' stuff — programs as long as 10k have been sent.

Dutch radio has issued a booklet containing the protocol for the transmission system and translation programs for some of the most widespread computer types. You can get more information from Hans G Janssen, Hobbyscoop, Postbus 1200, 1200 BE Hilversum, The Netherlands.
Frants Liisberg, Hvidovre, Denmark

## What's up DOC...

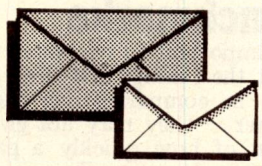
We were interested to read, in your November issue, the letter — under the heading 'Horror DOC'— from Mr Kay of OCLC Europe. Presumably the spelling mistakes are not Mr Kay's fault *(Mea culpa — Sub Ed)* although the grammatical errors at the end of para 1 and in lines 2/3 of para 3 could be — 'I could only stand to read. . . ' Dear, oh dear! Most people read sitting down!

However — his complaint is valid enough, even though it is a not unnatural consequence of the appallingly low standard of discipline and education which the Welfare State has managed to produce in the last 30 years or so.

When we started Moffat Rose, we insisted on speaking and writing plain grammatical English with a minimal use of computer jargon. In writing our own programs, I was given the tedious and boring job of translating the verbiage into grammatical English. As we develop and improve a number of so-called standard programs, I have been appalled at the amount of muddled thought processes which appear in program manuals. Indeed, some of the paragraphs frequently make so little grammatical sense that even our computer staff find it difficult to understand what the author is trying to convey! A major problem is translating what is euphemistically referred to as 'Regional English' into plain, internationally understood English.

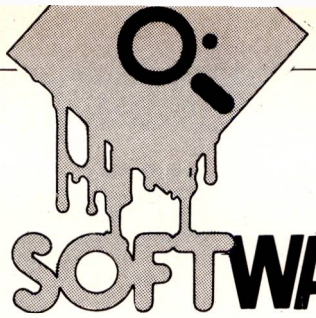
Aside from the above chore, we too believe that it is essential to provide a client with a disk-based self-teaching program which he can print if he wishes. In addition, we will modify it to include any points which a client may feel we have taken for granted.

This program is called Roseteach and is included free with systems which we supply. We do not supply hardware manufacturers' manuals, unless requested, as they tend to confuse the first-time or lay user.
P Murray Lee, Moffat Rose Ltd



```
10 'SPACE.BAS'
20 REM THIS IS A SPACE SIMULATION ON SCREEN
30 RANDOMIZE 12548:DEFINT A,C-G,I-N,X:B=61440!
    :T=65535!
:M=4095:VA=61282!:HA=61281!
40 PRINT CHR$(26)
50 FOR I=1 TO 120:X=INT(RND(5)*M):POKE
    (B+X),46:NEXT I
60 FOR I=1 TO 10:X=INT(RND(6)*M):POKE(B+X)
    ,42:NEXT
70 FOR I=1 TO 4
80       X=INT(RND(7)*M):Y=B+X:POKE Y,79
90       IF X=0 THEN Y1=Y+127 ELSE Y1=Y-1
100      POKE Y1,45
110      IF X=T THEN Y2=X-127 ELSE Y2=Y+1
120      POKE Y2,45
130      IF X<128 THEN Y3=Y+3968 ELSE Y3=Y-128
140      POKE Y3,73
150      IF X>3968 THEN Y4=Y-3968 ELSE Y4=Y+128
160      POKE Y4,73
170 NEXT I
180 L=128:BK=4096:POKE VA,0
190 AH=PEEK(HA):AV=PEEK(VA)
200 IF OH=AH AND OV=AV THEN 250
210 V1=(AV+11)*128:IF V1=>BK THEN V1=V1-BK
220 H1=AH\2+34:IF H1=>L THEN H1=H1-L
230 PO=B+H1+V1
240 NC=PEEK(PO):POKE PO,0:POKE OP,SC:SC=NC
250 OH=AH:OV=AV:OP=PO
260 GOTO 190
270 END
```

*Osborne screen routine: see 'Fix wanted'*




# DATABASE COMPARISON THE STORY SO FAR

*Kathy Lang pauses in her series of database evaluations to bring a comparison of the systems she's tested so far.*

In this series so far I've looked at nine packages for managing files of information, ranging in complexity and price from Cardbox, a simple but powerful 'electronic card index' system running under CP/M and costing £155, to FMS-80, a complex and sophisticated system with its own programming language and costing (in its full version) £650. In this article I shall try to put together some of the qualitative information in a way which will make it easier to compare packages and also show the results of some Benchmarks to try and get some feel for comparative speed.

## Benchmarks

It is important to remember when looking at the timings that these are only of value in comparing one package with another — they may not give any indication of how quickly a package will run on your system. The machine I used for the tests was a Sirius with 128k of memory and a Z80 processor card; all the tests on CP/M packages were run on the Z80 card under CP/M-80 with the exception of DMS, for which I used the native 8088 processor. I wouldn't expect that to make any significant difference when comparing DMS with the rest, as by far the major limiting factor in data management is disk access time, where the hardware is of course the same for both processors. Silicon Office runs only on the PET so to run those tests I borrowed a 80-column PET with two 500k disk drives.

The tests themselves were conducted using a test file of plain text data created by a Basic program. The purpose of this was to ensure a completely determined set of data identical to all the packages and relatively easy to transport to each system. The data file consisted of 1000 records containing seven fields and 46 characters, which were then imported into a file, where each record contained 21 fields, totalling 152 characters. This arrangement made it possible to test the package's agility at importing information from elsewhere and the efficiency of the storage methods (since part of each of the larger records could either be null or blank, depending on the file organisation). The tests were designed to cover the major headings I've used in assessing each package. The results of each test are shown in a table under the relevant section, with an attempt at a qualitative assessment of the same facilities alongside. The purpose of the latter is to try to give some impression of the power and ease of use of the particular facility, as well as its speed.

Four of the packages I tried, Cardbox, Silicon Office, DBMSIII, and FMS-80, were able to read my file only if I wrote a special program (in any language, SO own, Basic, EFM respectively) for the purpose. DMS, dBaseII and Condor all had commands or procedures for the purpose, so a program wasn't needed. To import 'stranger' files into Aquila and Pearl requires a special one-off program which can be written only by its originators; apparently for Pearl this can be done only in the US. The Aquila writers agreed to do this for my tests but, unfortunately, neither their data file nor the new version of DBMS from Grama (Winter) arrived in time for this article, so I shall include those timing tests in a later article.

## Data models

Most of the packages in this series call themselves 'data base management systems' but, unlike true DBMS, they are all basically single file systems. They thus do not vary tremendously in file organisation and methods of direct access to information. All hold their data either in linear files with indexes, or in relational files with or without indexes. (All that is meant by 'relational' here is that every field in the record is 'related' to every other, without any explicit hierarchy or network arrangement — in fact DBMS does use a kind of network to link records from different files together, but not within a single file.)

Five of the packages (Condor, dBaseII, DBMS, FMS-80 and Pearl) permit the linking of two or more files by keys, although the DBMS approach is rather unusual and requires more human intervention than the others. All the packages except Aquila, Cardbox and Condor use fixed length records and, with very minor exceptions, fixed length fields. Figure 1 shows the limitations each package places on size of file, record, number of fields, number of records, etc.

## Input and editing

All the packages require you to decide on at least an initial format for a data file before you can put information into it. I personally find the most satisfactory method of doing this is to 'paint' the format on the screen, in the way that most of the packages now permit (but not Aquila or DBMS). Some are easier to use than others — for instance, I found Silicon Office tricky because the start and end of field markers were very similar, and Cardbox's three-tier naming system I found very confusing. Once designed, and data inserted, the packages vary substantially in the ease with which you can add new fields. In Cardbox this is very easy; in dBaseII and Condor straightforward and in most of the others possible but more difficult and often slow. Figure 2 shows the time taken for each of the packages tested.

## Reporting

Only Cardbox uses the same mechanism for designing printed reports and for screen formats. This method of 'painting' the format on the screen is great provided you can keep within the single screen space. The other systems require you to specify row and column positions for each field, heading, etc, with calculations to be performed where this is permitted. dBaseII is rather limited in its ability to display report formats, though whether many users would ever get past the complexity of design to actually use all the features FMS-80 provides I rather doubt.

## Selection

It is, of course, very common to want to select records according to particular criteria and display or process them separately. I've used two measures of selection time: one uses two selection criteria and a simple sequential search (ie, no index is used), while the other uses an index and shows indexing as well as access time. Times for both tests

are shown in Figure 4. When comparing indexing time you should bear in mind the difference between dBaseII and Cardbox, which keep their indexes up to date as they go, and the others which only keep the index to the main key field up to date. You should also remember that both FMS-80 and DMS require you to set up a selection file first — you can't just ask for the selection and display in a single statement, and then modify your request in the light of the display. Condor is also rather inflexible, in that it creates a separate data file each time you request selection, even if you only want one or two records. In Silicon Office, you have to write a program for the kind of selection used in the tests (except when selecting on the key field), since the selection command does a sequential search of every field in every record in the file; my tests used a more discriminating method in a program, but it was still very slow.

# Sorting

Here the packages vary considerably in whether you can, or need to, sort the whole data file, or whether sorting the indexes is sufficient to enable you to display records in a particular order. DMS probably has the best approach here: the data file is never sorted, but individual indexes may be created and sorted so that the records are displayed in any required order. In FMS-80 you may sort either data files or indexes, but creation and sorting of indexes are two distinct processes. dBaseII allows you to sort the data file if you need to — and you will if you want to select using non-unique keys and then display in key order. Cardbox doesn't have a sort feature, a curious omission in a package so oriented towards bibliographic and free-text applications — surely libraries need their records in author or title order? Figure 5 shows sort times with one 20-character field as the key. The figures shown are for sorting index only, data only, or both, as appropriate.

Adding single records to the file can be done directly — that is by specifying a key value, displaying the record on the screen and editing it there — in all the packages except Condor, which requires the creation of a transaction file which is applied without intervention from the keyboard. This is the approach which is recommended in FMS-80, but not enforced. Personally I think much of the point of an interactive system is lost if you have to think up possible problems in advance rather than being able to check errors as you go. A decent file-handling system should be able to make on-line updating sufficiently secure for the batch process to be unnecessary except in special circumstances. Figures for batch and for on-line updating are shown in Figure 3.

# Indexing

Getting all the information in of course begs the question of how to get it out. All the packages (except Condor in its Levels 1 and 2 versions) have some methods of accessing particular records quickly, but they vary a lot in their power and flexibility. Silicon Office, DMS and FMS-80 require you to choose a primary key field and every record is indexed by that field. DMS and FMS-80 also allow you to create other indexes to permit fast access by more than one field but these are not kept up to date when the file is updated — you have to do this for yourself. dBaseII can keep up to seven indexes per file up to date 'on the fly'. These factors should be born in mind when looking at Figure 4, which shows the times for direct searching, since the indexing times are only significant if indexes have to be re-organised explicitly rather than being included as a (very small per record) overhead in the updating process. Cardbox is the most flexible of all in some respects, in that it permits indexing of all or any items (words) within fields either automatically or on request from the person updating. However, once you have put data into a Cardbox file, if you decide later that you want to index a field which was previously not indexed, then this can be very tedious.

| Package | Aquila | Cardbox | Condor | dBaseII | DBMSIII | DMS | FMS-80 | Pearl | Silicon Office |
|---|---|---|---|---|---|---|---|---|---|
| Max file size | 32000 recs † | 65500 recs † | 32767 recs † | 65535 recs † | 32000 recs † | 26214 recs † | CP/M limit | CP/M limit | 3 files per disk |
| Max size record | 472 chars | 1404 chars | 1023 chars | 1000 chars | 1400 chars | 1024 chars | 64k chars | 3080 chars | 252 chars |
| Max no fields | 20 | 26 | 127 | 32* | 20** | 60 | 255 | 250 | no limit |
| Max field size | 38 †† (255) | 1404 | 127 | 254 | 70 | 80 | 255 | 80 | 78 |
| Field | C | C | CDI£ | CNL | CN | CN | CDN | CDN | CN |

Notes: † = or CP/M limit (8 Mb), whichever greater * = unlimited no subfields
** = 200 subfields †† = predefined fields
Field types: C=Character/D=Date/I=Integer/N=real numbers/£=currency

*Fig 1 Constraints*

| Package | Cardbox | Condor | dBaseII | DMS | FMS-80 | Silicon Office |
|---|---|---|---|---|---|---|
| Time for 1000 records to add 1 new field to each | Inst's: just mod definition | 6m | 10m | 58m30s | 36m30s | 3h27m for 250 records |
| Star rating | **** | *** | *** | ** | * | * |

*Fig 2 Time to add one new field to each record*

| Package | Cardbox | Condor | dBaseII | DMS | FMS-80 | Silicon Office |
|---|---|---|---|---|---|---|
| Interactive time to add 50 records + | Inst's | NA | Inst's | Inst's | Inst's | 3 secs per record |
| Batch | 35s | 25s | 1m30s | 1m45s | 6m30s | NT |
| Star rating | **** | * | *** | ** | * | ** |

Notes: + excludes time to key in new data/NA=Not Available/NT=Not Tested

*Fig 3 Time to add 50 records*

| Package | Cardbox | Condor | dBaseII | DMS | FMS-80 | Silicon Office |
|---|---|---|---|---|---|---|
| Sequential Time for 1000 records | 2m31s | 2m + scroll | 3m20s total | 2m20s total | 4m5s + scroll | 4h25m for 263 records |
| Indexed access | 8s | NA | Inst's | Inst's | Inst's | NA |
| Create Index (25 char field) | NA | | (14m44s) if needed | 4m45s | 19m49s | (only one key field) |
| Star rating | *** | *** | *** | ** | ** | * |

*Fig 4 Sequential and indexed read (two criteria, 50 records match)*

| Package | Cardbox | Condor | dBaseII | DMS | FMS-80 | Silicon Office |
|---|---|---|---|---|---|---|
| Time to sort 1000 records on 5-char field | NA | 26m30s | 35m | 5m30s (index only) | NT | 1h10m for 250 records |
| Star rating | NA | *** | ** | **** | NT | ** |

*Fig 5 Sorting 1000 records*

# Screen display

Usually you can use the same features for designing a screen format for display and editing. Some packages, notably FMS-80, DMS, Cardbox and the later version of dBaseII, allow you to vary the formats so that some information is not displayed, or shown in different formats for different users. DBMS

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# DATABASE COMPARISON

(version III) allows you to 'tag' fields as protected for security reasons.

## Calculations

Since Cardbox and Aquila handle only text data, they can't do calculations. All the others have some calculating facilities. Those in DMS and FMS-80 are quite powerful — except that you can't modify the order of execution of expressions with brackets! In terms of power and flexibility, dBaseII is easily the best of those I've looked at in this area. Figure 6 shows two tests on calculation. The first involves replacing one field in each record with a value derived from a calculation on another field in the same record. The second simply totals three accumulators to give the sum total of each of three variables.

## Security

Important features are the ability to prevent unauthorised access to information, and to see what you've actually done in a session if something should go wrong. DMS and FMS-80 provide the most flexible approach to the first question, while DBMSIII has some comparable features. Looking at recovery from error and detection of possible deliberate fraud, DMS provides a paper audit trail, though I couldn't find a way to store this on disk; dBaseII allows you to record in a file everything which takes place on the screen. Cardbox has an explicit Repair function should the data become corrupted in any way.

## Tailoring

All the packages except Silicon Office and DBMS allow you to tailor the terminal interface to your requirements; SO comes already set up for the PET, and DBMS for whatever machine you've specified when ordering. Though some of the packages try to be helpful, this is still a very thorny area for anyone, especially the novice. I'd especially like to see every package make it possible to specify things like cursor movement codes by actually pressing the key concerned, then there's no mistake. Another essential feature is some confirmation that the tailoring has worked — before you leave the terminal definition part of the package. Also, the ability to edit an existing terminal definition, rather than starting from scratch, is another necessity. None of these packages did all these things.

As for tailoring the presentation of the package itself to your needs, this involves a sharp divide between the menu-driven packages and the command-driven sustems. With the menu-driven approach, as used by DMS and Cardbox, if your application fits that method of working you're fine, otherwise you just have to fit yourself round the package. Cardbox, particularly, would be even better if it had the ability to store search sequences for re-use, as Aquila does. In the command-driven packages like Condor, dBaseII and Silicon Office, you can set up files containing sequences of instructions to be executed as a group, including instructions for looping which give you the power of a programming language. You can use these features to construct menus of your own. Of the three, dBaseII is the most flexible, and the ability to call other 'programs' with parameter passing is very valuable.

FMS-80 combines these two approaches by providing menus for the simple things and a crude programming language for the more complex. However, unlike the other command-driven packages, the programming language is quite distinct in its syntax from the commands which execute FMS-80 procedures, and I found it quite difficult to use in anger — especially with the lack of comprehensible error messages. dBaseII is pretty unhelpful with its endless 'syntax error' messages, but FMS-80 often just stops and gives no clue as to why nothing has happened.

## Relations with outside

Most packages allow you either to read files written by other programs, or to write files for other programs, or both. To do the Benchmarks I had to read an external file, and Figure 7 shows the timings for reading the file in, restructuring it to match my '21 field' format, and doing any necessary indexing.

| Package | Cardbox | Condor | dBaseII | DMS | FMS-80 | Silicon Office |
|---|---|---|---|---|---|---|
| I calculation on 1 field on each record | NA | 4m | 6m | 12m30s | 7m10s | 25m for 250 records |
| Star rating | NA | *** | **** | ** | * | ** |
| Totals of 3 fields over 1000 records | NA | 1m30s | 1m30s | 14m | NT | 1 hr for 250 records |
| Star rating | NA | ** | **** | ** | * | ** |

*Fig 6 Calculations on 1000 records*

| Package | Cardbox | Condor | dBaseII | DMS | FMS-80 | Silicon Office |
|---|---|---|---|---|---|---|
| Importing a file | 23m30s | 13m | 13m | 39m17s | 16m40s | 4h45m for 250 records |
| Star rating | ** | **** | **** | *** | * | * |

*Fig 7 Importing a file of 1000 records*

| Package | Aquila | Cardbox | Condor | dBaseII | DBMSIII | DMS | FMS-80 | Pearl | Silicon Office |
|---|---|---|---|---|---|---|---|---|---|
| Cost | £310 | £155 | £195 £375 | £425 | £295 £575 | £400 | £350 £650 | £200 | £790 (floppy version) |
| Supplier | Kent-Barlow 01-580 7693 | Caxton 01-379 6502 | MOM 0474 57746 | Encotel 01-686 9687 | GW (Grama) 01-636 8210 | Comp-Soft 0483 505918 | Info-data 0962 69344 | Pearl 0202 741275 | Bristol Software 0272 277117 |
| Date of PCW review (1982) | Sept | August | Nov | May | June | March | April | Oct | July |

*Fig 8 Costs, suppliers and date of review*

## Stability and reliability

One of the more cheering features of these reviews has been the level of reliability of most of the packages — there have been occasional glitches, but very few, and I haven't suffered any loss of data or programs during the running of the Benchmarks. In fact my complaints have been more the other way — that once you have started a process going, most packages prevent you from interrupting it in any way — so if you've made a mistake you've had it. FMS-80 takes the sensible line of asking for confirmation that you want to abort.

## User image

Here I'm just going to touch on a few principles, because so much of this area is a matter of taste. Firstly, you need to know whether you prefer menu or command driven systems, and, if the former, whether your needs fit sufficiently one of the packages which only has menus, like DMS and Cardbox, or whether to go for a combined approach, like Condor, dBaseII and FMS-80. Whatever you decide, there is little substitute for giving the package a thorough road test yourself before you buy — though if the price is as low as £155, maybe you can afford to experiment anyway.

Consistency is, in my view, the most important element in the user image. You need to be able to generalise the way the package works, so that learning about one part makes it easier to use another. Personally, I found Cardbox,

*GOTO page 202*

# COMPUTER SCRABBLE

*Maggie Burton takes a look at a new game for the Apple II*

Computer Scrabble, from Little Genius, is the first popular board game in the UK to be computerised under licence from its manufacturers, JW Spear & Sons who, naturally, own both copyright and trademark on the game. The package was originally devised by Peter Turcan of Turcan Research Systems Ltd as part of a PhD thesis on word structure and analysis. It runs on an Apple II with disks. Computer Scrabble was launched at the 5th *PCW* Show this year, with a contest for all-comers who wanted to put their wits agains the highest level of the game.

## Getting started

You begin by cold booting the Apple as usual and Scrabble loads straight away. The beginning of the program is a rather lengthy display of the name, who wrote it and who markets it — which, to be honest, I found rather annoying (simply because of its length) after loading it up a few times. A Scrabble board is then drawn on the screen along with an empty scoreboard and the computer proceeds to ask you exactly how you want the game played.

## Options

The number of options is extensive, to say the least, I almost expected it to ask if I wanted it to sing, but it didn't go quite that far. Instead you can have one to four players in any combination of human and electronic, each one being assigned a name by the user for clarity. You can look at the computer's racks of letters if you want to and, if you couple this with a long delay in placing each letter in a turn, you can get a very good idea of what your electronic Thesaurus is up to.

One very useful provision is the allowance for a monchrome monitor. The game is really meant for use with a colour TV/Monitor but if you only have black and white you need only specify this and the board changes, offering symbols to indicate the value of each square. Once you've learnt these it makes no difference at all to the game. The colour board is designed to look as much like the real Scrabble game as possible, using all the same colours in the same order.

You can also have sound effects if you want them. These don't make much difference to a game like Scrabble (unless you're the sensitive type and they spoil your game). Those provided here consist of short clicks each time the computer moves the cursor or places a letter. I did feel that the addition of a beep or something when each different turn came around would have make this option more complete.

## The game

When you've answered all the questions about your game scenario you are instructed to turn over your disk and press 'Y' to load up the dictionary. I found the use of a double-sided disk rather unusual in a game but it works perfectly well. As soon as the dictionary is loaded up you go straight into play.

The dictionary contains 5000 words taken (with the expert help of Dr Alan Richter, a former British Scrabble champion) from Chambers'. I'm not being funny when I say it includes some very odd words indeed, at the same time rejecting words like 'mania' and 'cover'. It will, however, accept 'igloo', 'amen' 'loch' and 'ding'. I found this somewhat inconsistent ('igloo' contains as many vowels, for instance, as 'mania'), but it's fun all the same and it injects a helthy dose of character into the computer's play.

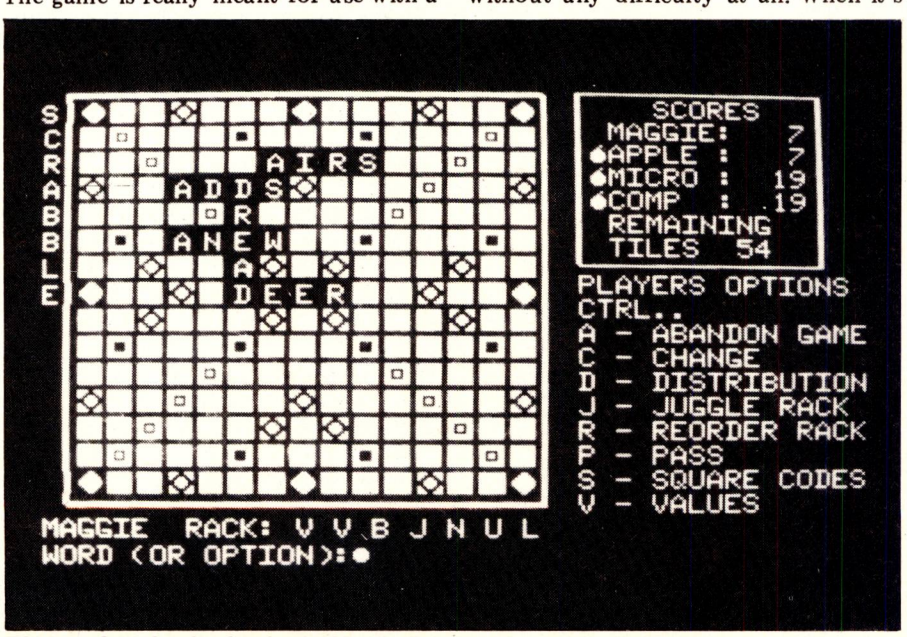
As an aside, I did discover (very easily) that you can cheat flagrantly without any difficulty at all. When it's your turn, you type in your word under the board, press return and then use the keys 'I', 'J', 'K' and 'M' (their positions on the keyboard explain which directions they control) to position the cursor where you want the first letter of the word to be. After this, you press 'A' or 'D' for across or down and the computer tells you what the word would score. You then have the option of rejecting it if it's not high enough. You can, if you want, type in your whole rack, place it in a legal position and wait for the computer to challenge it as nonsense. I typed in 'ELIPQOO' (score 96) and, when challenged, replied with 'ESC Y' which forces the computer to accept your decision as final. This is really only intended for words like 'mania' which are in Chambers' but not in the computer's dictionary. Words like this are not, fortunately, added to the computer's vocabulary.

Another little tip is to make frequent use of the playing option which allows you to juggle your letters around. This can give a great deal of inspiration. The playing options are only available when it is your turn.

## Conclusions

As I never normally play Scrabble I thought this game wouldn't be a particularly enjoyable one to review. To be honest, I was wrong. It's thoughtfully put together and fun to play — much more so, in fact, than playing Scrabble with people. The observation must here be made that I've never come across four people playing a game amicably sharing one keyboard — it's not the sort of thing you can pass around between turns. Our old friend the Apple II can play a demonic game and I only managed to beat it once on the hardest level (on which it scores an average of 300 points) although the lowest level of four is a fair challenge to the average adult. It's 'thinking' time is rather long but this only serves to make you feel at home. It takes about as long to make its moves as a talented player would which, coupled with some friendly humming and clicking of disk drives, makes for quite a homely game.

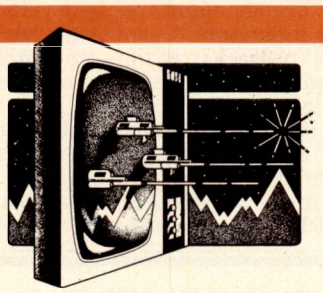
At £24.95 it'll make a fine Christmas present for a brainy son/daughter, although I do feel that the price will put it out of some people's range. Nevertheless, it's worth saving up for as it's the kind of game which lasts years rather than weeks. As it's not directly available from Little Genius their phone number is not included here. The game has been available to Apple dealers since September 9th and there should be several shops stocking it by now. Little Genius has plans to introduce versions of the game to run on other micros. Systems presently under technical review are: ZX Spectrum (which is the most probable second micro for this package), Atari, BBC Computer, TI99/4A, Dragon 32 and the Commodore 64. An 'advanced version' is also planned but details on this are as yet unavailable. END




*This is what the display looks like in the middle of a game. The board shows the symbols used with a monochrome monitor.*

# SCREENPLAY

*Dick Olney looks at games for the Tandy Color Computer.*



The TRS-80 Color Computer has been around for about a year now — in fact Steve Withers Benchtested one of the first few machines in the country in the September '81 issue of *PCW*. The system I used included 16k RAM and extended Basic (which is essential for all the cassette games); this sells for £369 including VAT. All of Tandy's proprietary games come as plug-in ROM packs, but for all the others you'll need a good cassette deck. In addition many of the games use joysticks, which cost around £20 a pair.

The computer itself is a pleasant looking machine with the standard Radio Shack grey plastic casing. It has a calculator style keyboard whose keys give a reassuring click when depressed. Tandy Extended Colour Basic has four graphics modes and can produce eight different colours. Only four colours can be used at any one time, however, since the two relevant graphics modes operate under either one of two different colour sets. In addition, the highest resolution mode is two-colour only (black/green or black/buff). The powerful 6809 processor is certainly under-utilised in a system of this size,but the Color Computer can be expanded to 32k RAM and will take up to four mini-disk drives (153k each).

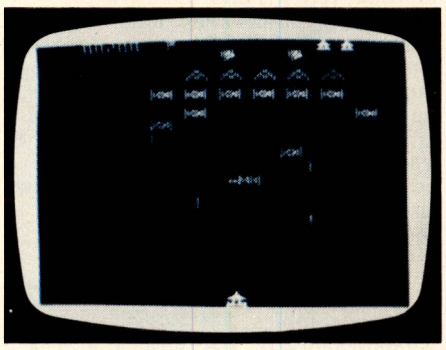
The worst aspect of this otherwise attractive set-up was the Japanese joysticks. The fire buttons rely on a thin metal disk of a shape designed to complete a connection when pressure is applied. This disk is constantly losing its shape and hence its spring, rendering the button permanently active. The problem can be temporarily alleviated by carefully disassembling the whole unit and bending the metal back into an appropriate shape, but it re-occurs with relentless insistence. With a bit of imagination some other small metal object might prove more effective than the disk, but I can't help feeling that Tandy should have come to that conclusion already and acted upon it.

As if this wasn't bad enough, I managed to shear the stick itself away from its screw mounting whilst engrossed in a game of Berserk (see review). I admit that it is easy to be inadvertently heavy-handed on such occasions, but I've used a good many different joysticks over the past year and have never broken one before.

Tandy has insisted on retailing the Color Computer itself and, perhaps as a result of this, there are few sources of external software in this country. This is a pity since Tandy's own selection of games is rather weak on the whole when compared with those I was supplied by Microdeal.

I should mention that I also got to borrow one of Tandy's new four colour plotters, designed to be used with this machine. Using a rotating barrel containing black, blue, red and green pens to produce text or graphics, it can easily be accessed with a Basic program to describe figures and diagrams on hard copy, with the only notable ommission being a circle function. This impressive peripheral sells for a very reasonable £150, inc VAT.

On the whole the TRS-80 Color is a well designed machine (with plenty of attention given to minor essentials like a long video lead) although its price brings it in line with machines like the Atari 800, which are rather too pricey for the mainstream home games market. It's a pity that Tandy itself hasn't done more to encourage external software in this country (like stock it in their shops!), especially as I gather there's so much of it available Stateside. The home computer market in this country is changing rapidly, with more and more high street shops stocking popular models and my advice to Tandy is to adjust their marketing approach accordingly.



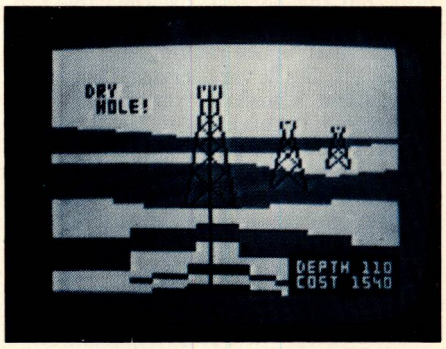
**Game: Galax Attack**
**Supplier: Spectral Associates**
**Price: £8.00**

This is, of course, yet another version of that infamous arcade game Galaxian. Four rows of three different shaped aliens sit above you Space Invaders style and swoop down in small groups; like Berserk, the titles are in colour and the actual play in black and white. The game is for one player who uses the right joysick for movement and firing. Personally I would have found the keyboard easier and I'm surprised that this isn't given as an option.

There is the opportunity to enter three initials at the outset of each game and the top five scores are displayed at the end. There is no skill level option, but play is fast and smooth and should present a challenge to the most enthusiastic Galaxian freak.

Unfortunately the shoddy Tandy fire button is rather inadequate for a rapid fire game of this type and needs constant adjustment, which is very irritating. Nevertheless this is a reasonable copy of a classic game.

| | |
|---|---|
| Use of graphics | ▰▰▰▰▰▰▱▱▱ |
| Response speed | ▰▰▰▰▰▰▰▱▱ |
| Value for money | ▰▰▰▰▱▱▱▱▱ |
| Addictive quality | ▰▰▰▰▰▱▱▱▱ |




**Game: Wildcatting**
**Supplier: Tandy**
**Price: £17.95**

With Tandy's headquarters being in the heart of Texas, it's not altogether surprising that this new management game is based on the oil business. Up to four players can take part with their names being entered at the outset. As in all good games of this type each turn consists of several phases. First you choose where to drill your well by moving the cursor around a blank dark green screen. Movement can be achieved either by using the joysticks or with the cursor control keys (you specify which at the beginning). Having chosen a likely spot (by pressing the fire button/space bar) you are presented with a surveyor's report, giving you the probability of striking oil, the cost of drilling per metre and the taxes you will pay each week (ie, turn).

At this point you must balance up the available information to decide whether to drill or not. Even with a high probability, the site may turn out to be a dry hole — and since a well will only produce income greater than its taxes for a limited period of time even a costly successful drilling can easily result in a significant loss. Choosing not to drill costs you nothing, but then you'll not make anything, either.

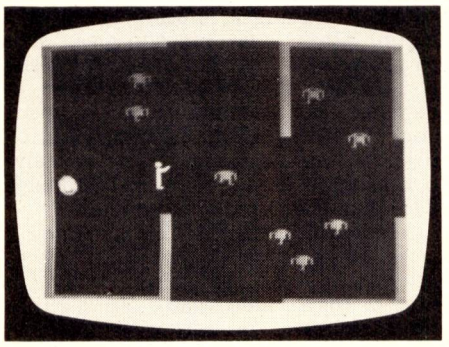
If you decide to go ahead you are presented with a simple but impressive picture of an oil tower, and a shaft driven into the ground by repeated depression of the fire button. Striking oil

results in a roaring gusher, while failure is rewarded with a deep buzz. In the final phase you are shown a list of all the sites you have investigated with details of their original cost, weekly tax and projected earnings before the next turn. Those mines which you own are marked with a coloured square, and can be sold for one half of their original cost. The idea is to sell each mine before its income falls below the level of tax, and then hopefully end up with a net profit...

Each site which has been investigated appears on the initial map as a square whose colour represents the oil probability. Since these colours tend to form a concentric pattern the most fruitful areas become more apparent as the game progresses. A game lasts for 13 turns (or weeks), at the end of which the entire map is displayed along with each player's balance sheet.

It is possible to accumulate scores (that is, game profit or loss) after several games, making for quite a lengthy competition. Wildcatting is not as complicated as it sounds though it is well thought out and could provide hours of entertainment for the right audience; that being children of around seven to ten years old. Most adults would, I feel, tire of it quite quickly since it involves neither coordination nor any real intellectual challenge.

| | |
|---|---|
| Presentation | 6 |
| Addictive quality | 3 |
| Use of graphics | 5 |
| Value for money | 4 |

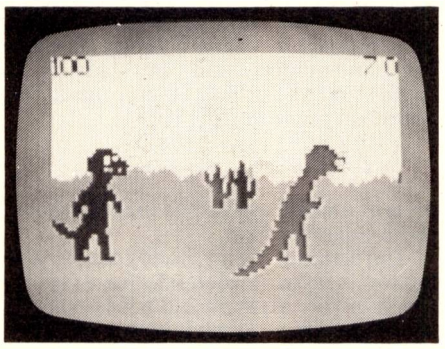


Game: Berserk
Supplier: Mark Data Products
Price: £19.00

A game for one or two players, Berserk is based on an increasingly familiar scenario. Using the joysticks you control a character who can move and shoot in eight directions; his task is to roam a series of interconnecting rooms destroying hordes of insane and deadly robots. Touching any of the walls or obstacles, or being hit by robot fire, results in the loss of a man (each game consisting of the standard three tries); In addition you are being chased by 'evil Orville', a little smiling face, who can move through walls and will kill everything he touches while remaining impervious to your fire.

The robots become more numerous and deadly as the game progresses, though their shooting is completely random so they frequently destroy each other (for which you are accredited points). Beserk is a good arcade type game, but is quite difficult to play, being responsible for the demise of the joystick I mentioned in the introduction. The graphics are excellent, though in highest resolution mode and thus black and white only (except the score card and intro which are in bright colours). As with many games for the Tandy, however, it's quite expensive as cassette games go.

| | |
|---|---|
| Presentation | 6 |
| Addictive quality | 5 |
| Use of graphics | 6 |
| Value for money | 4 |




Game : Dino Wars
Supplier: Tandy
Price: £17.95

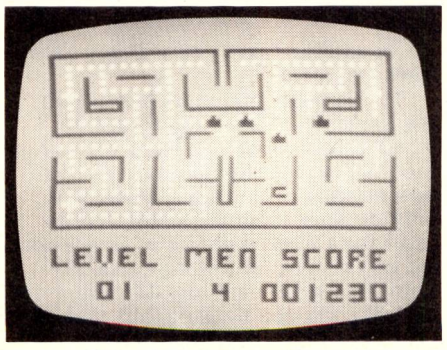
I couldn't resist reviewing this one, even though it's been around some time now and I'm sure many readers have already seen it at exhibitions, etc, or own a copy if they happen to be Tandy users. Joysticks are essential for this game, which is for two players. Each controls a dinosaur whose goal is to bite his opponent on the back of the neck. The dinosaurs roam a rather barren landscape with the odd cactus thrown in.

The creatures are brilliantly portrayed, though rather cumbersome to manipulate (added realism?), especially as it takes quite a while to get used to the perspective. When you have steered your dinosaur into a good position to attack, you press the fire button causing the beast's mouth to open (with a loud bloodcurdling roar). A successfully chewed victim falls to the ground with a few whimpers and a not particularly sickening thud.

Each player starts with 100 points and loses 20 for each wound received. Walking into a cactus also knocks five points from your score. The playing area continues off screen with a wrap-around effect, and it is quite possible to do battle when neither dinosaur is actually visible! The cacti make this manoeuvre dangerous, however, since clearly it is impossible to avoid them.

When a player has no points left, his dinosaur retreats into the distance whimpering pathetically, and the game ends. Dino Wars has good graphics and excellent sound effects. It is hardly the most complex or stimulating of games, but is nevertheless an inspired piece of lunacy which will appeal to anyone with a sense of humour. I'm not sure, however, whether that appeal would be lasting enough to warrant paying out the twenty quid it'll cost you.

| | |
|---|---|
| Presentation | 4 |
| Use of graphics | 5 |
| Addictive quality | 2 |
| Value for money | 2 |



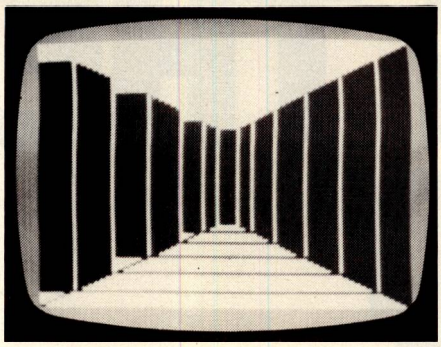

Game: Color Scarfman
Supplier: Cornsoft
Price: £11.95

Having been asssured that software copyright laws are much stricter in the States I can't help wondering how this American Pac-Man rip-off slipped through Atari's net. To add insult to injury, Scarfman is actually copyrighted by the Cornsoft Group in Indiana.

The standard maze takes up only two-thirds of the screen, with the score displayed at the bottom — a pity since it restricts the total playing area unnecessarily. There are five energy dots (plus signs in Scarfman) and five pursuers, who look like red laser bases. Either the joysticks or the keyboard can be used to control movement; and the maze remains the same throughout the game. The 'red monsters' remain vunerable to gobbling for quite a long time in the first few games (they turn blue), giving you plenty of time to clear areas of dots, but this decreases as the game progresses.

Scarfman is fast moving, giving good responses, but is very straightforward indeed and is probably the most uninspired Pacman copy that I've seen. Still it is the only version I know of for the Tandy Color, so if you want a version of Pacman for your machine I'd suggest you get in touch with Microdeal soon while it's still on the open market!

| | |
|---|---|
| Use of graphics | 3 |
| Response speeds | 5 |
| Addictive quality | 6 |
| Value for money | 3 |



**Game: Escape**
**Supplier: Tandys**
**Price: £8.00**

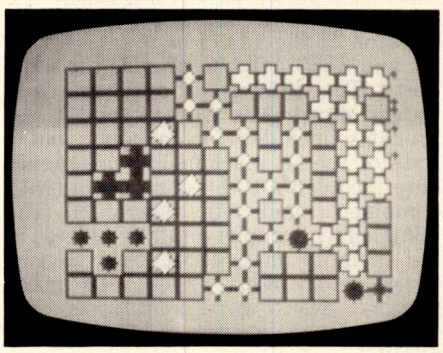
The blurb about this game describes it as a 3D maze adventure and it is just that. The maze represents the top floor of a building on which you are trapped, and is depicted in classic 3D maze style — remember it's the graphics that are 3D *not* the maze itself. Colour is used well here to produce the most convincing maze graphics that I've seen, with movement and turning being dealt with particularly well (the latter executed through the cursor control keys).

The only way to escape from the maze and thus solve the adventure is via an elevator, but attempts to use this without the right key result in you plummeting to certain death. Your task, therefore, is to investigate the various rooms and derive the necessary key from the clues contained therein. Most of these are presented as obscure riddles which should keep you guessing for many a long hour.

I have to admit I was sent the solution, which will shortly be made available to those who feel they would otherwise remain trapped forever. Without giving too much away I would offer a brief clue and a snippet of advice. Firstly remember that Microdeal is merely licensed to distribute this game, which was originally written by Colorsoft in the States. You should try to visit *all* the rooms before giving too much thought to the clues, since several of them rely on each other for their meaning.

This is in a different format to the usual adventure, with no monsters to kill and no treasure or useful objects to pick up, and is of a type which I can see becoming immensely popular. Though one could hardly describe it as a 'graphics adventure' the incorporation of a maze is an excellent way to present this particular puzzle (it also has a very interesting use of sound). You'll need a bit of patience to find the solution, though there are a few fairly easy clues to quell your frustration. Bear in mind, however, that the game is rendered worthless as soon as you've convinced the elevator to work and thus — as with other adventures — it's difficult to assess the value for money of this game.

| | |
|---|---|
| Presentation | |
| Use of graphics | |
| Complexity | |
| Value for money | |



**Game: Colour Space Traders**
**Supplier: Spectral Associates**
**Price: £8.00**

Although this game certainly is in colour the graphics do not play a particularly important part and it seems strange that the fact should be stressed in its title. Up to four players can take part, and the game involves building up intergalactic shipping companies. At the beginning of each turn a nine by twelve grid of squares appears on the screen. Some of these contain stars, indicated by red circles. Five of the squares flash red and blue accompanied by an extremely irritating little tune. A triangular marker can be moved between the squares by pressing the space bar. When the M key is pressed an outpost is set up in the current position of the marker.

The positioning of outposts is a vital part of the game and can have a number of results. If it is in a square adjacent to a star, or another outpost (not diagonally) then a new company is formed, heralded by a noise like a factory hooter and a 'news bulletin'. A player responsible for setting up a company automatically owns five shares in it, which are worth $100 for each square the company occupies or $500 for each occupied share adjacent to a star. If an outpost is set up next to an existing company it becomes part of that company and adds to the value of its shares..

When two companies are joined by a new outpost, the one with the highest share value envelopes its neighbour. At this point the holders of shares in the company which has been taken over are given half as many shares in the new company plus a cash bonus derived from the original share value. Up to five companies can exist at any one time and are denoted on the chart by various coloured symbols (you'll have to remember which symbol is which). In addition, if a company's share value rises above $3,000 its shares are split two for one — that is, all players' holdings are doubled and the price is halved.

After setting up an outpost players are given the opportunity to buy shares in any of the existing companies, regardless who was responsible for their inception. The cash made available to do this depends on quantity and value of current holdings. Each game lasts for 48 turns and the winner is the player who ends up with the greatest stock value.

I managed to work out the mechanics of the game fairly quickly, but devising a realistic strategy proved rather more difficult. Building up the value of a company in which a reasonable number of shares are held will increase the cash made available at the beginning of each turn. On the other hand, buying as many shares as possible in a small company while the shares are cheap, and then causing it to be taken over, yields high dividends in both share value and cash.

Space Traders is one of the most interesting games of its type I have played and is thoroughly recommended to anyone who likes this sort of thing. The considerations involved are subtle and complex enough to provide many interesting games, though it does take a while to master. I suggest it would prove rather too obtuse for very young players, and is probably best suited to a teenage or adult audience (compare 'Wildcatting' in this review). At this price, this game is almost certainly the best value for money I've seen on the TRS-80 Color, even though the program itself (written in Extended Basic) is fairly straightforward.

| | |
|---|---|
| Presentation | |
| Use of graphics | |
| Addictive quality | |
| Value for money | |

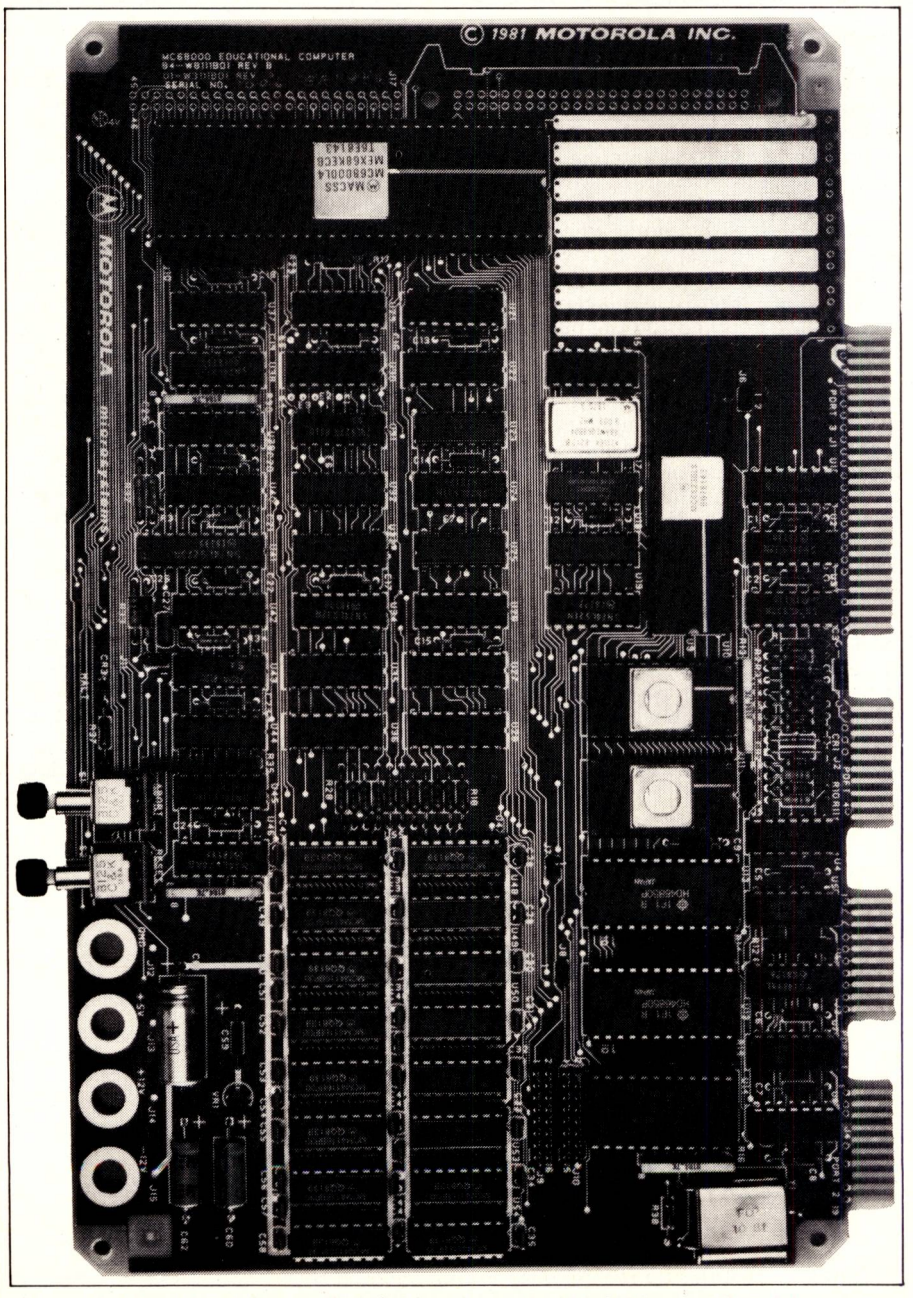


*'It used to be notes up the chimney asking for train sets — now it's all printouts requesting expansion interfaces and floppy disk drives.'*

# LEARNING THE 68000

*Mike Curtis checks out Motorola's powerful new MC68000 'Educational Computer'*

Many years ago, more than I care to think about now, my first introduction to the world of microprocessors was a MEKD1 Motorola 6800 development system. It came on a 250 x 150cm board and, along with the 6800 processor, it contained a massive 256 bytes of RAM, 4 parallel ports and one serial port, and the notorious MIKBUG ROM. Hooked up to a battered old ASR33 teletype it gave hours of enjoyment and education. It is surprising what you can do with 256 bytes! I have been a fan of Motorola processors ever since. The world has moved on a bit since then, and the latest offering from Motorola is the MC68000 Educational Computer; this comes in the form of a 265x165cm board and contains 32 kbytes of RAM, organised as 16k words of 16 bits, one parallel, two serial and one cassette port, and 16 kbytes of ROM containing the Tutor operating system.




*A crowded board — but spotting the processor shouldn't be too difficult!*

It is interesting to note that, despite all the development that has gone on in the time between the introductions of these two products, one important feature remains exactly the same; the combination of the 14411 baud rate generator and 6850 ACIA to provide the serial ports. The 6850 is an excellent chip, though showing its age now, and it was probably included for economy; but a state of the art machine like this should have included a 16-bit component (with combined baud rate generator). The 6850 is fact occupies a full two words in the memory map as opposed to two bytes in an 8-bit system. To make matters even worse, Motorola has actually used Japanese versions of the 6850!

The 68000 itself is an impressive 64-pin chip — this board uses the 4MHz version but there are other variations going up to 12.5MHz. The slower version is used here because this board is not intended as the basis of a full scale computer system, but as a stand-alone educational system for those people and institutions who are interested in using a 68000 system and exploring the capabilities of the chip. The other major components on the board are a 68320 PIA to provide the parallel port (this is a 16-bit component), 16 4116s to provide the RAM and two 64 kbit ROMs. There is a lot of TTL — no ULAs here — and two push buttons; a black Reset, which re-performs system initialisation, and a red Abort, which simply returns control to the operating system leaving registers and memory intact. Connections to the board are by means of four edge connectors for the various ports and four 'banana' sockets for the power supply: ground, +5, +12 and −12 volts. The user must supply his own power supply and RS232 terminal which connects to port #1. There are jumpers provided to set the baud rate individually for the two RS232 ports. The manual makes it clear that the second RS232 port is intended for connection to a host computer on which software can be developed using a cross-assembler or cross-compiler and then downloaded onto the board itself. Cross-assemblers and compilers are available for a number of machines, notably DEC minis and Motorola's own 6800

and 6809 systems. The board is well designed and of the high quality that you would expect from Motorola — it is a three layer board with one set of tracks sandwiched in the middle.

Informed opinion has backed the 68000 as the eventual winner in the 16-bit stakes, though in this country the Intel 8086 seems to have got a head start. We are only just getting the large systems such as the Wicat, which have been available in the States for some time. The 68000 is really a 32-bit processor, though it uses a 16-bit data bus — there is even a version with an 8-bit data bus, which seems to be rather restricting the capabilities of this powerful processor. I understand that there may well be a variant in the future with a full 32-bit data bus; one of those running at 12.5 MHz will be definitely worth at least an arm and a leg.

The 68000 breaks away from the Motorola tradition of accumulator, index registers and stack pointers to give 16 general purpose registers, though these are split into eight data registers, D0-D7, which are perhaps generalisations of the accumulator concept, and eight address registers, A0-A7, which are more like generalised index registers, with A7 and a parallel but normally inaccessible register A7' acting as stack pointers. Most operations can be performed on all 16 registers but, for example, byte operations cannot be performed on address registers, and data registers cannot be used in some forms of address modification. All registers (apart from the 16-bit condition code or status register) are 32-bit. Current versions of the 68000 do not support a 32-bit address bus, though this again may be a future development; however, the 24 bits available do give a possible address space of 16 megabytes, which should satisfy most people. The physical address bus in fact carries only 23 lines; this is because, although the 68000 will address individual bytes, memory access is always done using 16-bit words; the least significant address line A0 only exists internally within the processor and is used to refer to the individual bytes within a word once it is in a register.

Connection of an RS232 terminal is straightforward enough but there always seem to be problems with the supposedly standard interface; the data in and out lines 2 and 3 needed to be interchanged for my terminal to work and this particular interface needed the DTR handshaking signal from the terminal, which neither my own terminal nor the other ones I could obtain provide. It can be tied up to +5 volts, however, and after wasting some time with a jumper to ground the computer eventually sprang to life with the message 'TUTOR 1.2>'.

The Tutor operating system gives a comprehensive set of commands to examine and modify registers and memory, set and remove breakpoints, single step through programs and control the various elements of the system. When examining and modifying memory locations there is an assembler/disassembler option which allows programming directly in assembly language; the 68000 has a very comprehensive instruction set along with a great variety of addressing modes; consequently it is not really practical to program directly in hex as can be done with most 8-bit processors. The minimum size for an instruction is eight bytes and many instructions need the full eight bytes! This is not a true assembler; it does not allow labels, so branching has to be done to absolute addresses, or the correct offset calculated, and there is only one directive 'DC.W' to set a one word data constant. However, it does make the task of programming much easier.

The assembler is a subset of Motorola's own standard assembler rather than a custom design for this board. This produces a couple of minor niggles: the assembly mnemonic has to be preceded by a space to indicate no label field, even though labels are not allowed, and the assembler takes decimal as the default number representation with hex values preceded by a $ sign, whereas the rest of the operating system takes hex as the default and decimal numbers have to be preceded by an & sign. This latter problem is eased somewhat by the provision of a DC (Data Convert) command which converts between decimal and hex, though it can still be irritating to have to quit in the middle of writing or running a program to convert from one to the other before restarting.

There is not sufficient space here to go into the details of the 68000 instruction set but there are a number of noteworthy features:

Most instructions can operate on bytes, words (16 bits) or long words (32

| Command | Description |
|---|---|
| .A0—.A7 | These commands without parameters will display the contents of one of the address registers; if a value or numerical expression is given as a parameter then the value is placed in the register. |
| .D0—.D7 | Display or set the data registers. |
| .R0—.R7 | Display or set the Program Counter. |
| .PC | Display or ser the Program Counter. |
| .SR | Display or set the Status Register. |
| .SS | Display or set the Supervisor Stack Pointer. |
| .US | Display or set the User Stack Pointer. |
| BF a1 a2 w | Block Fill from address a1 to a2 with word w. |
| BM al a2 a3 | Block Move the block from a1 to a2 to start at new address a3. |
| BR a1 | Set a breakpoint at address a1. The option ;n will cause the breakpoint to be passed n times before a break occurs. |
| NOBR | Removes breakpoints. |
| BS a1 a2 d | Block Search the memory from a1 to a2 for data d, which may be a literal string or a numerical value. A numerical value may be masked by a bit pattern and there are byte, word and long word options (;B ;W or ;L). |
| BT a1 a2 | Block Test of memory between a1 and a2. |
| DC e | Data Convert a numerical expression e. |
| DF | Display Formatted registers; this is done automatically when tracing or at breakpoints. |
| DU a1 a2 | Dumps memory from a1 to a2 in Motorola S format. The DU may be followed by a port number — eg, D04 will dump through the cassette port. |
| GO a1 | Executes a program starting at address a1. |
| GD a1 | As GO but ignoring breakpoints. |
| GT a1 | Commences program execution at the address in PC, setting a temporary breakpoint at a1. |
| HE | Help — gives a list of all commands. |
| LO | Loads S-formatted records; this may include a port number —eg, LO4 would be used to load a cassette tape, LO2 (the default) to download from a host. |
| MD a1 c | Memory Display a total of c bytes starting at a1. This will normally give hex and ASCII values but with the ;DI option it will disassemble giving hex and mnemonics. |
| MM a1 | Memory Modify starting at address a1, locations can be left unchanged or modified. Normally as each location is dealt with it will automatically move on to the next; the order may be reversed by entering and the function is terminated by a full stop. The ;DI option may be used to enter data in assembly mnemonics and other options allow data in words and long words as well as odd addresses or even addresses only. |
| MS a1 d | Memory Set starting from address a1 with data d, which may be hex or an ASCII string. |
| OF | Displays the contents of the offset registers R0-R7. |
| PA | Printer Attach, copies all screen output to the Centronics printer port. |
| NOPA | Displays the printer. |
| PFn | Display or set characteristics for serial port n (1 or 2) — eg, number of start and stop bits. |
| RM | General register display and modify. |
| TM | Transparent mode connects the two serial ports together so the terminal communicates directly with the host. |
| TR | Trace, single steps through a program starting at the current PC value. |
| TT a1 | Inserts a temporary breakpoint at address a1 and traces to that point. |

*Table 1*




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# LEARNING THE 68000

bits) by the addition of .B, .W or .L to the mnemonic, with word being the default in most cases.

Absolute addresses in instructions which refer to words or long words must (obviously) be even.

The MOVE instruction is a general purpose load and store instruction which takes the form 'MOVE source, destination', where source and destination may be registers or memory locations, or immediate values in the case of the source. Taking into account the different addressing modes this gives a staggering 12,288 different options in this one instruction.

Many of the addressing modes allow auto increment or decrement on an address register by 1, 2 or 4, thus allowing easy access to tables of bytes, words or long words.

The DBcc instruction (cc can be any of the usual conditions LE, LT, GT, etc), which takes the form DBcc Dn, r, will automatically decrement the data register Dn and perform a relative branch to r bytes from the current address where r is a 16-bit quantity. This gives a useful loop primitive.

There is no simple indexed addressing mode — instead there is a BASED mode where a 16-bit offset may be added to a base address in an address register; and a BASED INDEX mode where an 8-bit offset within the instruction may be combined with the contents of any of the 16 registers and the base address in one of the address registers. These give easy access to data structures other than arrays, such as linked lists.

There are MUL and DIV instructions which will multiply two 16-bit quantities to give a 32-bit result and divide a 32-bit quantity by a 16-bit divisor, giving a 16-bit result.

There are two particularly useful variations on the MOVE instruction; MOVEP, which can be used to move values to a peripheral interface, where by virtue of the absence of an A0 address line the registers within the interface chips will be only on even addresses; and MOVEM, which can be used to move multiple registers to a block of memory.

Some instructions have a short (.S) or long (.L) option, depending on whether the full 24-bit addressing is used or a shortened 16-bit addressing. The use of the shortened form gives a more compact object code, and is especially useful for systems which are only using a maximum 64k address space. Some instructions using a small immediate value (three bits) can use a special form with a Q suffix which places the immediate value in the same word as the opcode — again saving space.

The 68000 chip can operate in two states, user and supervisor; there are some 'privileged' instructions which are effective only in supervisor state. This is to enable the processor to perform memory management functions as the heart of a multiprogramming system. The state is determined by the condition of some of the high order bits in the condition code register.

The 68000 has a comprehensive system of traps whereby most types of errors, such as trying to access non-existent memory, division by zero, or illegal opcodes, cause control to be passed through a number of vectors into the operating system. There is a TRAP instruction which causes a software trap to occur and this, rather than the more usual direct jumps or subroutine calls, is used to communicate between a user program and the operating system. Tutor uses exclusively TRAP #14 for this purpose, and by moving the appropriate function code into D7 calls can be made to a variety of operating system routines — to handle input/output, for example. The following sequence of instructions is necessary to return control to Tutor:

```
MOVE #K228,D7 (moves the immediate
value 228 to D7)
TRAP #14
```

Other calls may require additional parameters to be placed in other registers.

The Tutor operating system incorporates eight pseudo registers, R0 to R7. These contain offset values which may be added to any address given in a command; thus assisting the development of position independent code. For example, the command MD 1000+R5 would give a memory dump starting at address hex 1000 plus the contents of R5, so if R5 contained 2000 the dump would start at hex 3000. R7 always contains 0 and by default R0 is added to every address. If, for example, R0 contained 1000, the command .R0 0 would not set R0 to 0 as you might expect since the current value of R0 would be added on and would hence be unchanged; however, .R0+R7 would have the desired effect.

The Tutor commands shown in Table 1 take the general form:
mnemonic <parameters> ; <options>

This comprehensive set of commands makes programming a relatively painless task; the trace and breakpoint functions help debugging, and the ability to single step through code, displaying the contents of registers and memory when appropriate and running quickly through sections of code which do not need to be examined in detail make this an ideal educational machine.

The short program in Figure 1 multiplies two 32-bit numbers by repeated addition, and illustrates some of the features of the language. It is entered after the command MM 1000;DI. The two arguments should be in D0 and D1, and the result will be in D2. The sequence of commands to run the program is;

```
.D0 n1
.D1 n2 (n1 and n2 are the two
arguments).
GO 1000
.D2 (to display the results)
```

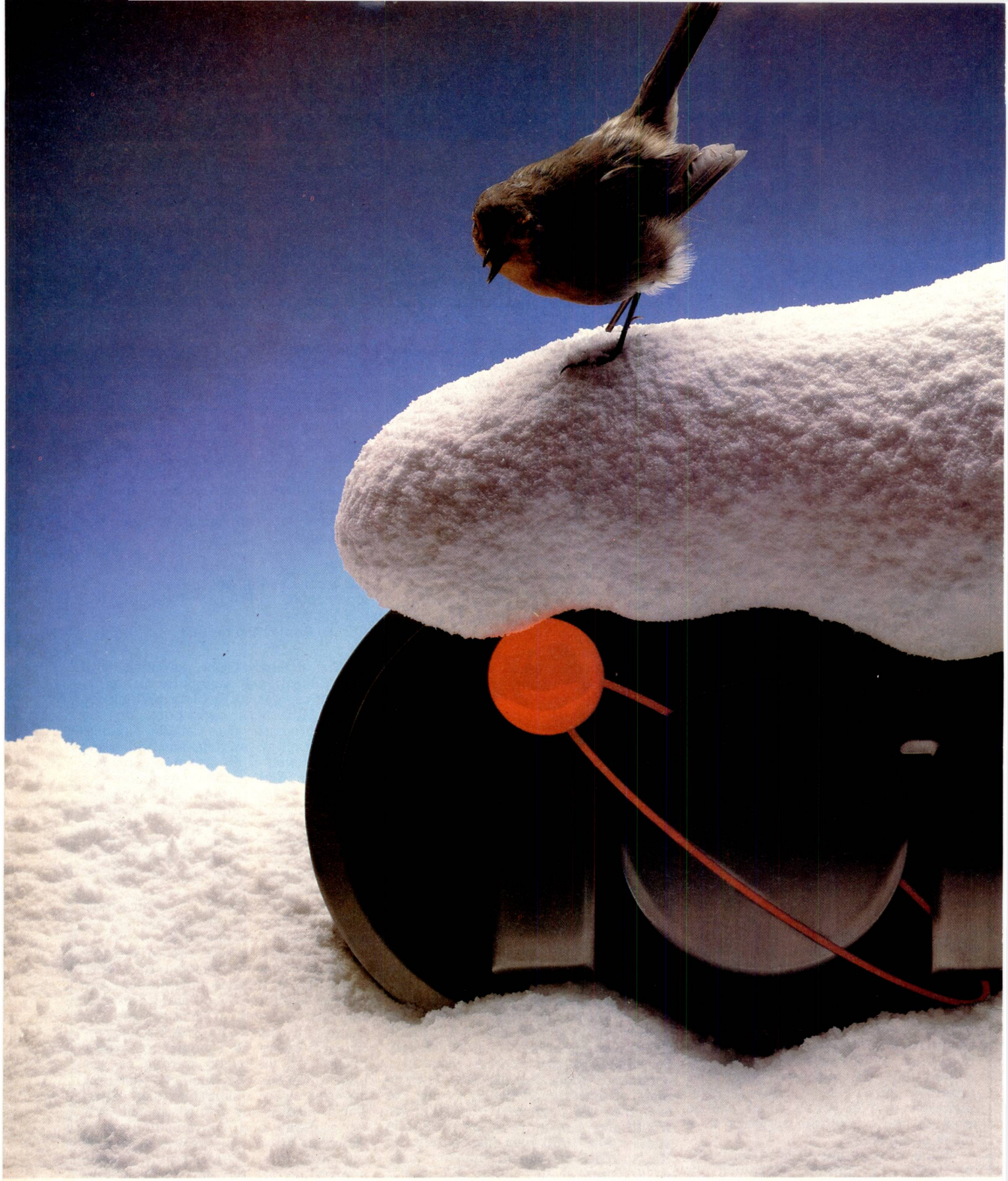
The documentation supplied with the Educational Computer is quite impressive, despite being a preliminary copy. Motorola's own book on the 68000 processor gives detailed explanations for all instructions and addressing modes as well as the instruction manual for the Educational Computer. It assumes a fair degree of knowledge already, but then this is not a system for absolute beginners. The only real lack was a source listing system, but I understand that copies are available free from Motorola when the user registration card is sent back.

The MC68000 Educational Computer does not set out to be either a stand-alone machine or the basis of a larger system. It sets out to provide, preferably when connected to a host computer, a suitable environment for learning about the 68000 and its instruction set. As such, it does its job admirably. It costs £510, which is not particularly cheap, so I would not expect queues of hobbyists waiting to get hold of the latest technology. There are, however, many companies and educational institutions for whom this will be a cheap and convenient way of educating people in the use of one of the most powerful processors around in preparation for the day when systems using this chip may well be as common as those using the 6502 today. It is also a useful tool for those wishing to learn a modern assembly language.

*The MC68000 Educational Computer can be obtained from Thame Components Ltd, Thame Park Road, Thame, Oxon OX9 3XD; telephone 084 421 4561.*

| Address | Hex code | Assembly |
|---|---|---|
| 001000 | 4282 | CLR.L D2 |
| 001002 | 2600 | MOVE.L D0,D3 |
| 001004 | 670E | BEQ $1014 |
| 001006 | D481 | ADD.L D1,D2 |
| 001008 | 048300000001 | SUB.L #1,D3 |
| 00100E | 60F4 | BRA $1004 |
| 001010 | 3E3C00E4 | MOVE.B #228,D7 |
| 001014 | 4E4E | TRAP #14 |

*Figure 1*



# WE WISH YOU A MERRY CHRISTMAS. AN

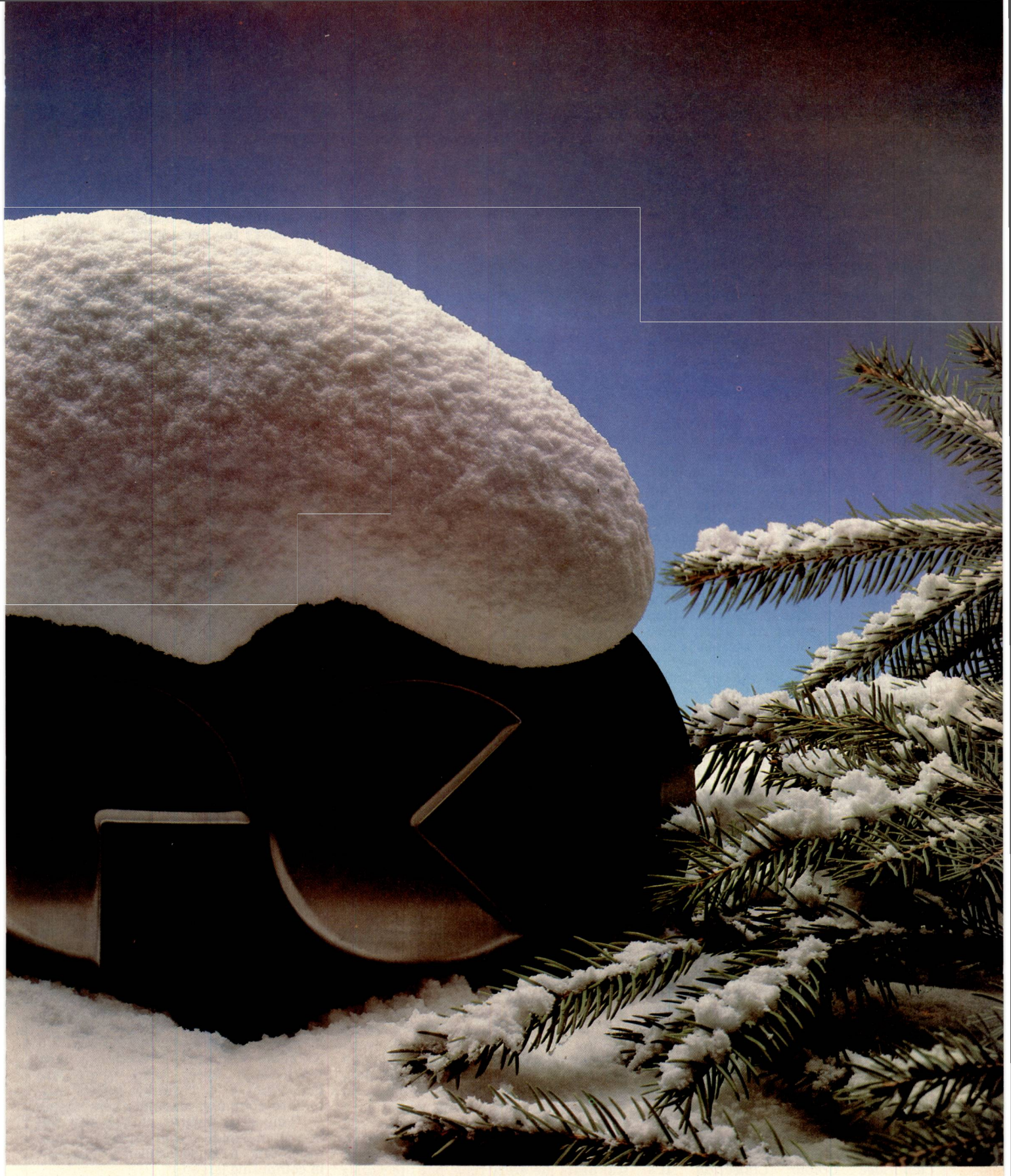
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# READ ALL ABOUT IT!

*Steve Mann casts an eye over the first batch of Spectrum instruction books*

Let me start by saying that I received these items with a fair amount of cynicism. I was certain that there was a bit of bandwagon-jumping going on here. After all, the ZX81 had provided a very good living for all sorts of peripheral manufacturers and publishers and, with the launch of the Spectrum, I'm sure that publishing houses all over the country were calling meetings and saying, 'Look, there's obviously a market crying out for product here. We did okay with the ZX81 — let's tart up some of that material and get it out pronto before someone else cleans up.'

Don't get me wrong — I'm a wholehearted devotee of the quick buck and, indeed, but for an overwhelming indolence, I would have been tempted to have been out there jostling in the marketplace myself. But, anyway, I was suspicious, and not predisposed to rave about any of the early Spectrum material.

In the event, I was pleasantly surprised. Although there may be nothing here that's astoundingly innovative, the standard, in most cases, is more than adequate. The speed in which these books appeared on the shelves is also indicative of the vast improvement in turn-around times in the publishing industry these days — much of this material has been available for some months now.

I was also impressed with the accuracy shown in the program listings. With very few exceptions, all the programs I tried ran first time, and what mistakes there were — a repeated program line in one instance, a GOTO 25000 instead of 2500 somewhere else — were obvious and easily amended.

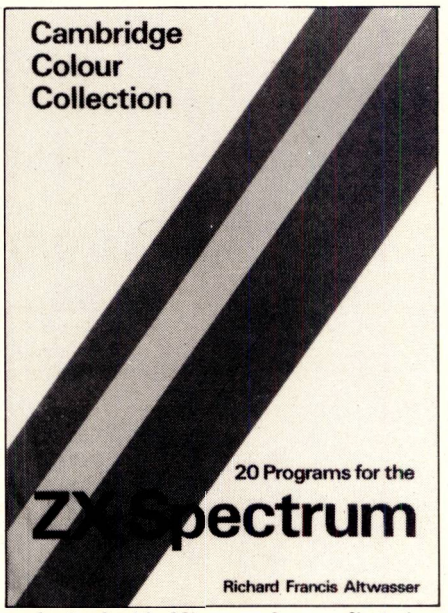
So, anyway, let's assume for the sake of argument that you have actually received your Spectrum. You've waded your way through the sometimes incomprehensible, sometimes downright misleading Spectrum manual, and you want more. You want more program listings, and you want more hints and tips on how to get the most out of your new machine. What benefits are you likely to get from the material here?

---

*The Cambridge Colour Collection — 20 Programs for the ZX Spectrum:* written and published by Richard Francis Altwasser, £6.95.

First out of the stalls was Richard Altwasser, writer and publisher of *The Cambridge Colour Collection*. It's hardly surprising that Richard had a head start on the rest of the field — as one of the Spectrum designers he would be expected to know a little about the machine.

I must confess that a cursory examination of Richard's book seemed to confirm my worst fears about exploitation. A slim (64 pages), expensive (£6.95) little volume, it hardly seems to break any new ground. The 20 programs concentrate on tried and trusted old favourites like lunar lander



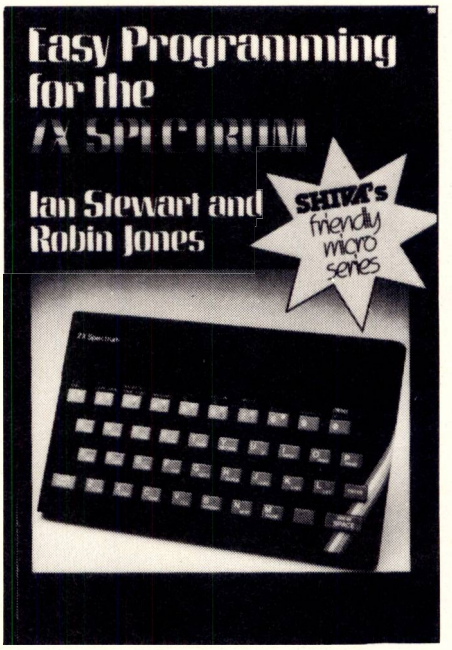

and Android Nim, and my first impressions were unfavourable, to say the least. Apparently there is a companion cassette, costing £2.95, with all the programs ready for immediate loading. I say 'apparently' because, despite two different promises of delivery, I have been conspicuously unsuccessful in getting my hands on one. So, showing remarkable devotion to duty, I spent several evenings and a weekend keying in the listings from the book.

So, at just fivepence under seven quid, what do you get for your money? As mentioned above, the programs do not inspire initial enthusiasm, and the notes to most of them are somewhat sketchy, rarely more than a couple of paragraphs. But, despite this, I feel the book is well worth investigating, especially if you are unsure of the graphics capabilities of your Spectrum. I feel that a large percentage of Spectrum users will be ZX81 freaks who have upgraded, and keying in these listings is a painless way of learning some of the new techniques necessary to get the most from their new toy. Altwasser has compacted his programs very neatly, and, although there are no specific programming hints here, each program illustrates some aspect of the Spectrum's potential. In addition, they're *fun*. Altwasser's robots in Android Nim squeak and gibber in a most satisfactory manner, then roll their eyes piteously as you wipe them from the screen. The damn program still beats me every time, but the visuals can't be faulted.

On a more serious note, there is a very useful character generator program for user-defined shapes. This differs from the one on Sinclair's free 'Horizons' cassette by giving you a display grid of 25 characters, so you can easily combine several different characters to make a large Space Invader-type graphic.

Also very useful is 'Notebook', which features a neat little machine code search routine and which, slightly amended, is doing sterling service in the Mann household as a video index.

A bit on the expensive side, then, but if you just want a score of programs that aren't too demanding but will give you an idea of what the Spectrum can do, then this is probably for you.




*Easy Programming for the ZX Spectrum* by Ian Stewart and Robin Jones (Shiva, £5.95)

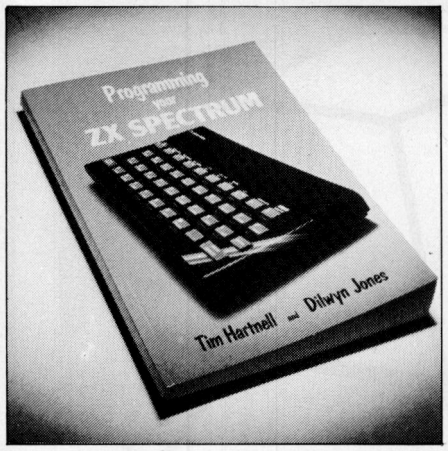
A strange one, this. Part of 'Shiva's friendly micro series', *Easy Programming* is by Ian Stewart and Robin Jones, authors of the bizarrely titled *PEEK, POKE, Byte and RAM* for the ZX81 — a name they disclaim responsibility for, incidentally, insisting it was 'foisted on us by our publicity man'. The authors describe this as being the Spectrum version of *PEEK, POKE* etc.

The preface says this is 'a gentle guide to Basic programming, programming style, colour, sound, moving graphics, high-resolution graphics, debugging, number-crunching and string-handling. When you've read this, the manual will be easy meat.' Okay, I'll go along with that. Everything's kept short and sweet, and there are indications of a healthily cynical attitude to computer manufacturers' claims — 'This is a feature of the way the Spectrum handles the display. (A bug which can't be fixed is called a "feature" in computing jargon.)'

The debugging sections are excellent; the program notes explain exactly how each program runs and give suggestions for improvements, and the authors are largely successful in their claim that 'lots of computer books give the impression they're trying to prove how clever their authors are. We're not doing that: everything here is very straightforward and basic.'

I was very impressed with the way the book is organised. The chapters are all kept to a sensible length, with

examples liberally scattered throughout and an extended program section, complete with notes, at the back. The sections on debugging are similarly dotted throughout the volume, and I would say the authors have succeeded in their stated aims. That said, I must also add that I found the appearance of the book spoilt by a selection of truly cringe-inducing cartoons — 'De Bugs' — which are distributed liberally throughout. It's probably something that's lacking in my sense of humour, but I found them twee and unfunny in the extreme. What's worse is that, for me at any rate, they detract from what is really a useful and well-put-together book.




*Programming Your ZX Spectrum* by Tim Hartnell and Dilwyn Jones (Interface Publications, £5.95)

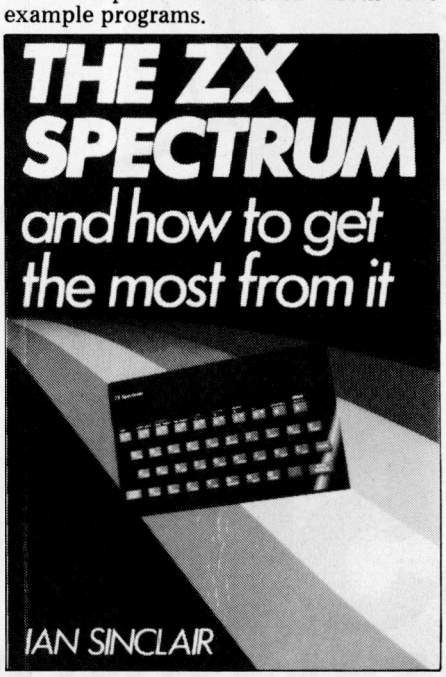
Never reticent about coming forward, Tim Hartnell — the Barbara Cartland of the micro book industry — was off the mark with almost indecent haste with this weighty tome, written in conjunction with Dilwyn Jones. By 'Barbara Cartland' I don't mean to imply that Tim dresses up like a chocolate-box illustration (I don't know, though. . .), or that he pops thousands of vitamin pills daily, but, my God, is this man prolific! The author of books too numerous to mention here on the ZX81, the VIC-20, the BBC Computer, various guides to buying a computer, etc, this was his first for the Spectrum, although I notice he's come up with another one already — this time with the added attraction of a foreword by Clive Sinclair, which will no doubt add a certain air of authority to the volume.

This is a fat 230-pager, aimed at the beginner, and it progresses at a comfortable pace from basics ('Using the keyboard', 'The PRINT statement') through to some more advanced concepts and useful stuff like using the shifted cursor keys to give diagonal movement (excellent for games). Tim and Dilwyn do a good job of helping the beginner avoid the pitfalls encountered when writing programs, and the writing style is clear and undemanding. As is compulsory these days there's a section on structuring your programs, and — a nice touch, this one — a section on commands in other Basics and advice on how to achieve the same effects in the Sinclair dialect. There's also a collection of handy subroutines, covering things like partial screen clear, left and right scrolling, and aligning columns of numbers to the decimal point.

Along the way there's an exceedingly naff Pacman-type game, and an astounding cock-up. 'Prime numbers are very easy to determine,' say Hartnell and Jones, then proceed to give a program to generate them and a sample printout of the first 20. All well and good, but a touch more care in the proofreading would surely have spotted that the program thinks 9 is prime!

I can't help thinking that the programs themselves do not do justice to the text that surrounds them. They are all the sort of thing that you might key in once to see what each one does, but which you will never return to later on. In an ideal world, the programs in *The Cambridge Collection* would be combined with the instruction given here. As it is, you'll either have to buy them both or use the techniques explained in this book to write your own — which is probably the best way of going about learning how to program, anyway.

A boon to the beginner, then — but don't expect too much from the example programs.



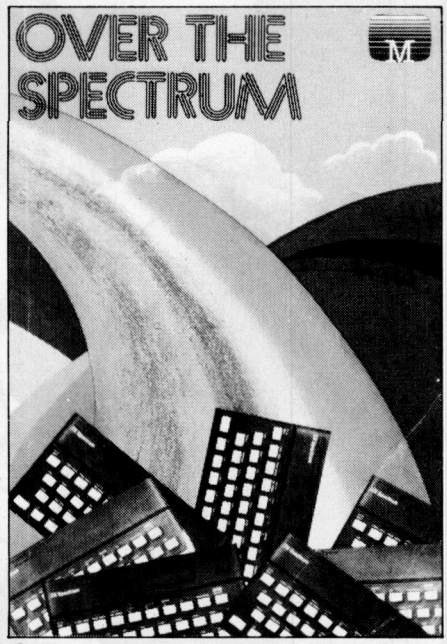

*The ZX Spectrum And How To Get The Most From It* by Ian Sinclair (Granada, £5.95)

Ian Sinclair (no relation) aims at the same market as the Jones/Hartnell opus, but concentrates less on silly games and more on developing programming technique.

After the 'Introduction' and 'First Steps' chapters, the book is broken down into six main areas: 'Variables', 'Loops, repetitions and arrays', 'Data processing', 'Graphics', 'Sound' and 'Roll Your Own' — a nifty little section on writing your own programs.

I can't get too excited about this book, but then I can't knock it either. It does exactly what it sets out to do, competently if a little uninspiringly, and has some useful tips in its various appendices for aligning your tape recorder correctly, and modifying your recorder leads so that you don't have to unplug one of them when LOADing and SAVEing.

There must be a lot of people out there who don't want to play 'blob-chaser' games, and this book attempts to cater for those who would prefer to find out more about storing and accessing data, or who want to move on as quickly as possible to writing their own programs. I found it worthy, if a little dull in its approach. My advice? Try before you buy.




*Over The Spectrum — 30 Programs for the ZX Spectrum* (Melbourne House, £6.95)

The final entrant in the Spectrum Stakes is Melbourne House's *Over the Spectrum* — and, for me, at least, it runs out the clear winner. Emphatically *not* a 'teach yourself programming' guide, *Over the Spectrum*, like Richard Altwasser's book, is simply a collection of programs, but unlike the *Cambridge Collection* each program has a detailed breakdown of exactly what happens when, and how it's all achieved.

The listings are not trivial, and care should be taken in keying them in, but the result is well worth the effort. The book is liberally illustrated, in colour, showing the screen display for almost all the programs contained therein — so you know what you are trying to achieve from the outset.

As a demonstration of what can be achieved using the Spectrum's user-defined characters, this book cannot be faulted — several of the programs require 50 or so user-defined characters — and, although it contains no programming hints as such, a diligent reader is going to learn a lot about the Spectrum by working his or her way through it.

Worthy of special mention are probably the slowest fruit machine you'll ever see — but, oh, those graphics! — and a sophisticated character generator which allows you to work on four characters at once, and allows things like mirror-images to be obtained at the touch of a key. There is also a neat little program to turn your Spectrum into an alarm clock, which I find myself using frequently — it would benefit from one of the external amplifiers produced to beef up the Spectrum's sound output, but I find that even the unmodified volume level produces an insistent BEEPing that should rouse you.

No author is credited for the book as a whole, but the bulk of the programs come from Beam Software, Clifford Ramshaw and Neil Streeter. Take a bow, gents — and give us more.

END



# THE PCW £5000 MANHUNT

You should be pretty well fed up with looking at Pythagorean triangles by now. If you read the question properly you should have at least five answers to part three of the puzzle (and a lot more if you didn't!). What we neglected to tell you is that you need to find the *smallest* such triangle — ie, the one with the smallest perimeter.

Got it? Okay, you now have six numbers written down: three multi-digit ones and three single-digit ones. Take the multi-digit numbers and write them down one after the other in the order they were obtained. This gives you a nineteen-digit number.

Now cube it (accurately!).

Now you have a rather intimidating 57-digit number.

You also have the following text in enciphered form:

EYOMHDKLZ C2OTLY3LDYZMØ4Ø67E4B8ACA5

which contains the name, rank and phone number you're looking for.

Go to it! The three single-digit answers could help you if you knew how.

By the way, members of the KGB (and their relatives) are not eligible.

When you have it deciphered, ring the number and leave a message for this person on the answering machine (use his/her rank or you may give offence). The message is just the three single-digit numbers (to show you solved the puzzle and didn't get there by any devious dealings).

If you want the prize money, best leave your name and address as well.

Good luck — don't spend it all at once!

*J J Clessa*

*Note: PCW staff will not enter into* any *telephone or other communication about this problem, so please don't bother them.*

# TJ's WORKSHOP

*Our monthly pot-pourii of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', PCW, 62 Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.*

## SOFTWARE DRIVEN 2MHz/1MHz ATOM

I found A Clements' article on how to modify the Atom to run at 2 MHz extremely interesting.

I eagerly followed his instructions and was delighted to find that the 6502 did indeed run at 2 MHz. However, as pointed out, loading and saving programs necessitated switching the machine back to 1 MHz. A further drawback is that the machine locks up after being switched, thus requiring BREAK followed by OLD to restore the program.

This simple hardware modification uses the spare output line PC3 to switch from one speed to the other.

The modification necessitates cutting two tracks on the Atom circuit board. The first, on side 2, is the track from pin 10 of IC44, as described in Mr Clements' article. The second cut is on side 1 of the board. Locate and cut the link LK5 which connects pin 1 of PL4 output socket to pin 39 of IC31. The Atom board mods are then complete, except for the wire connections to the circuit shown in Figure 1.

The circuit was constructed on a small piece of Veroboard and mounted using two insulating washers on side 1 of the Atom board, just below IC37/39 and above the keyboard connection for the BREAK key. The siting of the board is not critical and may be left to the constructor's own judgement. A 3/16in hole was drilled in the board in order to pass the insulated wire connections from the Vero circuit on side 1 to the Atom circuit connections on side 2.

Modifications complete, the machine should be switched on and should display 'Acorn Atom' as normal. If this is not the case, check that all connections have been made correctly and that both cuts in the tracks are clean. It will be necessary to carry out the RAM tests indicated by Mr Clements in order to ensure that the correct speed RAM chips have been used.

To switch from 1 MHz to 2 MHz, simply set bit 3 in location Hex B002 — eg, !#B002=!#B002:FF08. The machine will now be running at 2 MHz and can be checked simply by typing CTRL G. If a high-pitched bleep is heard instead of the usual low note, then success. If not, unset bit 3 and try again. If the note is still the same, check all wiring, etc. If it is a high beep, then the default speed at switch on is 2 MHz and you should swap the connections to pins 5 and 11 of the 74LSOO chip to change default speed to 1 MHz. Programs can now automatically control which speed they run at by setting or unsetting bit 3 of Port C, without the machine locking up.

One advantage of this method is that any commands to handle the cassette interface — ie, LOAD, SAVE, CAT — will automatically switch the machine back to 1 MHz. However, it will be necessary to reset the m/c to 2 MHz after saving or loading.

*A S Birds*

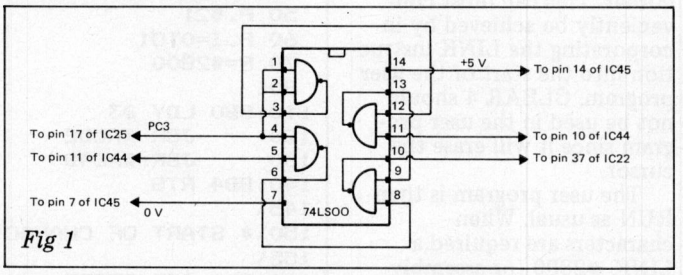



*Fig 1*

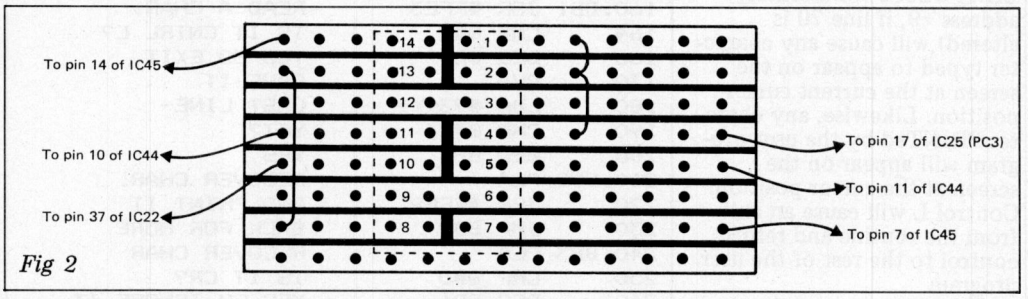



*Fig 2*

## VIC TIP

Here's a useful tip for the Vic-20. Many Vic-20 owners will by now be familiar with the problems of using hi-res graphics with the 8k cartridge. Basic has to be shifted from $1200 to $2000 to make room for the user-defined graphics.

This is quite a simple operation if you know how to do it, but for the average user with only the Inane Computer Guide to consult, like myself a few months ago, it can seem like a formidable problem.

Here are the necessary commands:

```
POKE 32*256,0
POKE 44,32
NEW
```

The last line is very important as it saves you the bother of changing all the variable pointers just after 44 in the zero page.

Once you have typed in the commands, you will have about 8000 bytes left for Basic programs, which you can type in and save as normal.

Substituting a lower number for 32 in lines 1 and 2 will give you more memory for Basic and less for graphics.

*Quentin Gore*

## UK101 RUBOUT

On the assembler/editor for the UK101, SHIFT/0 has to be used in order to rub out the previous character if a mistake is made when typing in a program. This can become very confusing.

Here is a patch that will allow the RUBOUT key to be used as it is in Basic. To accommodate the extra machine code, the pointer to the start of the source file must be altered by changing $12C9 to $B4. The JSR $FCEA at $1399 must be changed if a monitor other than NEWMON is being used.

*David Hunter.*

```
1311  209113    JSR  1391

1391  AD0302    LDA  1399
1394  F003      BEQ  1399
1396  4CEBFF    JMP  FCEFEB
1399  20EAFC    JSR  FCEA
139C  C91C      CMP  =1C
139E  D013      BNE  1383
13A0  A908      LDA  =08
13A2  20EEFF    JSR  FFEE
13A5  A920      LDA  =20
13A7  20EEFF    JSR  FFEE
13AA  A908      LDA  =08
13AC  20EEFF    JSR  FFEE
13AF  68        PLA
13B0  68        PLA
13B1  A95F      LDA=SF
13B3  60        RTS
12C9  B4
```

# TJ's WORKSHOP

## ATOM TEXT 'N' GRAPHICS

This program allows text, both upper and lower case, to be mixed with graphics on a graphics screen (Mode 4) — a facility long needed by Atom owners. It makes use of routines contained within the Acornsoft Word Pack word processing ROM which must be in the utilities ROM socket for the program to work.

The program is assembled in #2800 and uses 64 bytes. If floating point variables are to be used by the user program, line 70 must be changed to an alternative assembly address.

It is used as follows:

Once assembled and therefore RUNning the user program, a LINK #2800 (or as 70 if altered) must be performed. This will clear the screen to mode 4 and a cursor will appear at the top left corner. This can most conveniently be achieved by incorporating the LINK instruction into the start of the user program. CLEAR 4 should not be used in the user program since it will erase the cursor.

The user program is then RUN as usual. When characters are required,a LINK #2809 (or assembly address +9, if line 70 is altered) will cause any character typed to appear on the screen at the current cursor position. Likewise, any charcter PRINTed by the user program will appear on the screen at the cursor position. Control L will cause an exit from the routine and return control to the rest of the user program.

The program operates as follows:

Lines 110 to 140 alter the 'read character' and 'write character' addresses (#20A, #20B, #208, #209) to those required by the word processor.

The rest of the program reads characters typed in by the user and displays them at the current cursor position.

The cursor keys operate in the usual manner.

If 'control L' is typed, the routine will be left, and the user program returned to. If an alternative character is required as the exit command, line 164 should be altered to:

164 CMP @ASCII CODE FOR DESIRED CHARACTER.

To prevent the screen from scrolling if the bottom line is passed, the program (lines 180 to 200) continually monitors the contents of location #93, which is where the word processor stores the screen line number. 21 lines of text are possible (0 to #14). When the last line is reached, carriage return and line feed commands are ignored.

The other cause of scrolling is if a character is typed into the rightmost position on the bottom line; lines 300 to 320 watch for this and allow only left cursor, up cursor and delete commands to be used once this point is reached.

Characters can be inserted anywhere on the screen, but care should be taken that a character does not over-write any required graphics. It should also be remembered that a space is a character and, if typed, will erase a small rectangular area of screen above the cursor.

*J J Smith*

```
 10 REM- ROUTINE TO ALLOW MIXED TEXT
 20 REM- AND GRAPHICS IN GRAPHICS MODE 4
 30 REM- USES THE ACORNSOFT WORD PACK.
 35 REM- COPYRIGHT JERRY SMITH
 40 DIM BB4
 50 P.$21
 60 F.I=0TO1
 70 P=#2800
 80[
110:BB0 LDY @3          } SET UP WORD
120      JSR #ACDE      } PROCESSOR
130      JSR #AC4B      } ADDRESSES
140:BB4 RTS               EXIT
145\
150\* START OF CHARACTER ENTER ROUTINES *
155\
160:BB1 JSR #FFE3         READ A CHAR.
164      CMP @#C          IS IT CNTRL L?
166      BEQ BB4          YES SO EXIT
170      PHA              SAVE IT
180      LDA #93          LAST LINE-
190      CMP @#14         YET?
200      BEQ BB3          YES
210:BB2 PLA               RECOVER CHAR.
220      JSR #FFE9        AND PRINT IT
230      JMP BB1          BACK FOR MORE
240:BB3 PLA               RECOVER CHAR
250      CMP @#D          IS IT CR?
260      BEQ BB1          YES SO IGNORE IT
270      CMP @#A          IS IT LF?
280      BEQ BB1          YES SO IGNORE IT
290      PHA              SAVE CHAR.
300      LDA #E0          POSITION ON LINE
310      CMP @#1F         END OF LINE?
320      BNE BB2          NO
330      PLA              RECOVER CHAR
340      PHA              SAVE CHAR.
350      CMP @#B          IS IT CURSOR UP?
360      BEQ BB2          YES
370      CMP @#8          IS IT CURSOR LEFT?
380      BEQ BB2          YES
390      CMP @#7F         IS IT DELETE?
400      BEQ BB2          YES
405      PLA
410      JMP BB1          IGNORE ANYTHING ELSE
420]
430  NEXT
440  P.$6
450  END
```

## SHARP CHARACTERS

**The Sharp PC-1500 is pretty remote (ouch) from being a terminal, but it is still good TJ fodder. I have been delving into the inner workings of the machine, and have found a lot of interesting goodies. Here is a program to illustrate one of the most useful.**

The Sharp generates displayed characters by software, and so (like the ZX81) the character generator is accessible to programs. It starts at 64672 (&FCA0) with the entry for the space character. Each entry consists of five bytes of dot column image which can be passed to GPRINT. The sixth column is always blank and consequently does not appear in the table.

With a bit of manipulation it is possible to print characters upside-down or back-to-front, but the most useful application of the table is for for printing double-width characters, as in this demonstration program.

```
 5 REM    DOUBLE WIDTH CHARS
1Ø WAIT Ø
2Ø INPUT "STRING? ";A£
3Ø FOR  I=1  TO  LENA£
4Ø A=ASC(MID£(A£,I,1))*5+&FCØØ
5Ø FOR J=Ø  TO 4
6Ø B=PEEK(A+J)
7Ø GPRINT B;B;
8Ø NEXT J
9Ø GPRINT "ØØØØ";
1ØØ NEXT  I
11Ø PAUSE
12Ø GOTO 2Ø
```

The display annunciators (BUSY, RUN, etc) are memory mapped and appear at &764E and &764F. Sorting out which bit belongs to which symbol is left as an exercise for the reader, but beware — there is a surprise in store!

By the way, does anyone know what the OPN instruction does?

*Malcolm Ray*

# TJ's WORKSHOP

## SPECTRUM ERROR

One of the reasons a machine code user may want to display a message on the screen of a ZX Spectrum is that an error has been made somewhere. In many examples one of the Sinclair standard error codes could be used. For instance, in some assembler programs, an attempt to load a single register with a number above 255 could be met by report code 6 — 'Number too big' or report code B— 'Integer out of range', either of which can be followed by a line number and statement number of the programmer's choice.

The trick is to use a ROM subroutine at 0008h. The command RST 8 in a machine code program then gives a return to Basic. The following byte should contain the number one less than the error code wanted, and addresses 5C45h and 5C46h should contain the low and high bytes of the line number. Address 5C47h contains the statement number.

For example:

| | |
|---|---|
| LD HL, 1234 | 21 D2 04 |
| LD (23621),HL | 22 45 5C |
| LD A,5 | 3E 05 |
| LD (23623),A | 32 47 5C |
| RST 8 | CF |
| 18 | 12 |

The short program above will give the message: 'J Invalid I/O device 1234:5'.

But if you look in the Sinclair manual, only codes 0-0-9 and A-R are listed. What do other values give? Some very interesting reports. Error

```
 1 REM. .
10 POKE 23760,207
20 FOR n=0 TO 255
30 POKE 23761, n
40 PRINT USR 23760
50 NEXT n
```

T, for instance, is the Sinclair copyright message. Type in the accompanying six line program, REM statement included, and run it. You get error code 1. Type in NEXT N and press ENTER, and you get error code 2. Repeat this and you work your way through all 256 codes. I hope you can find some useful ones — good luck to your typing finger!

*Bill Longley*

## PET MOVEMENT

Nearly all PET 'movement' games which I have seen published in your magazine in the past two years use a method of movement a great deal slower than the method I use, which to my knowledge I invented!

This makes use of PEEK (515), which gives the current key pressed and an array and can be adapted for various types of movement — and no doubt for other machines also.

*T H Ley*

```
1 PRINT"♥":POKE33333,214
5 C=33333:X=0
10 DIMA(255)
20 A(50)=-40:A(18)=40:A(42)=1:A(41)=-1:R=515
30 REM BASIC)1:A(184)=-40:A(178)=40:A(180)=-1:A(182)=1:R=151
35 REM +++ SET UP THE SCREEN +++
40 FORT=1TO40:POKE32767+T,224:POKE33727+T,224:NEXT
50 FORT=0TO960STEP40:POKE32768+T,224:POKE32807+T,224:NEXT
60 REM MOVEMENT
70 X=A(PEEK(R)):IFPEEK(C+X)<>32THEN70
80 POKEC,32:C=C+X:POKEC,214:GOTO70
```

## SPECTRUM SCREENMAP

Owners of the new Sinclair Spectrum may have discovered that the memory map for the screen is arranged in a very unconventional way.

The screen is divided into three sections each of eight character lines by 32 character columns. Each character is eight bytes deep The first scan of 32 bytes is of the first byte of each character from the lines 0-7; then the second and so on. Which is repeated for lines 8-15 and 16-23. . . confused? Well, here is a short routine to unscramble the screen map for conventional screen pokes. Y has the value 0-6143 (0= top right hand corner: 6143= bottom left hand corner). T contains the corresponding location in the screen map.

In return for this, could your readers advise me of a way of constructing a conventional screen map — ie, with the Scans arranged left to right, one line below the other.

*(Name omitted! Please contact us.)*

```
1000 LET T=INT(Y/2048)*2048
1010 LET Y=Y — INT(Y/2048)*2048
1020 LET T=T+INT(Y/256)*32
1030 LET Y=Y — INT(Y/256)*256
1040 LET T=T + INT(Y/32)*32
1050 LET Y=Y — INT(Y/32)*32
1060 LET T=T + Y + 16384
```

## BLUDNER

In September's *PCW* you published a letter from me under the title 'Appendectomy'. The published text contained two omissions which rendered it senseless.

It should have read

1) Load first program
2) PRINT⌣TOP-2 (note ⌣ sign omitted)
3) Then type *LOAD "second program name" XXXX where XXXX is the address that was printed in 2) [you omitted the XXXX and comment].

*R Jewsbury*

## BEEB STRING SEARCH

Here is a program that will fit in one function key on the BBC Micro. It will search through a Basic program, looking for a specific string (You INPUT it), and will report all line numbers at which it occurs. This is very useful in debugging long programs (eg, Adventures), where you have lost track of where certain procedures and variables are mentioned. NB: the program cannot search for Basic keywords as they are stored as token values.

```
*KEY O"CLS¦INPUT"
"Enter string""N$:P=PAGE+
1:REPEAT:N=256*P?0+P?1:
P=P+2:L=P?0:NL=P+L—2:P=
P+1: IF INSTR ($P,N$)  0
THEN PRINT¦N:P=NL:
UNTIL P?0=&FF:END:ELSE
P=NL:UNTIL P?0=&FF:
END¦M"
```

To execute a search press key 'f0' and enter the string you wish to search for when prompted. The program will reply by listing all the line numbers at which the string occurs.

While on the subject, there is a function key bug. The function keys can hold a maximum of only 255 characters (a good reason to use abbreviations for keywords). If you try to enter too many characters you will get a 'Bad key' error. What the computer does is to take the number of characters already in the key, add it to how many more you wish to put in, and if the answer is greater than 255 it reports an error. However, if you are redefining a key it still adds the number of characters already in the key, even though they will be deleted. This may lead lead to a 'Bad key'error when in fact there is nothing actually wrong. The best way around this is to type *KEY N"" (where N is the number of the key you wish to define) before defining your key.

*Ian C Brodie*

## BEEB BREAK

Did you know that the Break key on the BBC micro can be defined, just like the other 10 user definable keys?

I find this particularly useful for OLD¦M¦NLIST¦M

*Philip Gigg*

# TJ's WORKSHOP

## BEEB TAPE SALVAGE

In answer to many a BBC Micro owner's prayers I offer my own version of a tape salvage program. As many BBCers will know, the 0.1 operating system has two bugs in the cassette filing system. This program attempts to salvage a program which had block 0 corrupted due to one of these bugs. According to Acorn, this bug would corrupt, on average, block 0 of one program in 16.

There is now a well publicised m/c fix for both of these bugs but, alas, these have arrived too late for many users.

My program will attempt to read in as many Basic lines as possible, starting from any block number until the end of the program is reached. Errors in the format of the data coming from the tape will simply mean a missing line of Basic which the user will have to re-enter but at least he/she will not have to retype 10k of program lost because the first block is unreadable.

The data bytes are detokenised as they are read from tape using the crunch subroutine in the Basic ROM converting single bytes to Basic keywords so that a check can be made of the lines coming in. However, I am detokenising all but the line number and the line length, and consequently characters within quotes and GOTO/GOSUB statements will appear to be incorrect when in fact they are okay.

I suggest that the m/c fixes are chained in before loading this program to ensure when you resave your salvaged program you do not have to repeat this process unnecessarily.

To use the program type RUN and position your cassette to just before the program to be salvaged. The program will list to the screen as it is found on tape and is stored above this program in memory. When the end of the program is reached or ESCape is pressed the program will reset PAGE to start of the salvaged program. Typing LIST will display the salvaged program which can be saved in the usual way.

If you are not satisfied with the salvaged program, type BREAK then OLD <CR> and repeat the process.

*Paul Mudditt*

```
10 ON ERROR PRINT'':REPORT:PRINT" error at line ";ERL:GOTO 310
20 CRUNCH=&B53A:REM THIS SUBROUTINE DETOKENISES BASIC
                    OR PRINTS THE ASCII OF A%
30 REM SELECT SHORT MESSAGES
40 *OPT 1,2
50 REM MAKE COMPUTER IGNORE ALL TAPE ERRORS
60 *OPT 2,0
70 page=(TOP DIV 256)*256+256:REM SELECT NEW PAGE VALUE TO LOAD
                                PROGRAM INTO.
80 index=0:REM page OFFSET POINTER
90 X=OPENIN(""):REM LOAD ANYTHING ON THE TAPE
100 REM SELECT NO TAPE MESSAGES FROM NOW ON
110 *OPT 1,0
120
130 REPEAT A%=BGET#X:UNTIL A%=&0D:PRINT:REM WAIT HERE UNTIL WE FIND THE START
    OF A NEWLINE OF BASIC TEXT.
140 PROCPoke(A%):REM POKE IN &0D '<CR> CHARACTER' TO START PROGRAM STORAGE
150
160 REPEAT:Lastnewline=index
170   LnH%=BGET#X:PROCPoke(LnH%):REM 1st BYTE IS HIGH PART OF LINE NUMBER
180   LnL%=BGET#X:PROCPoke(LnL%):REM 2nd BYTE IS LOW PART OF LINE NUMBER
190   L%=BGET#X:PROCPoke(L%):REM LENGTH OF BASIC LINE
200   PRINT TAB(20);LnH%*256+LnL%;:REM DISPLAY LINE NUMBER
210
220   REM THIS PART LISTS BASIC LINE TO SCREEN AND STORES IT IN MEMORY
230
240   REPEAT
250     A%=BGET#X:PROCPoke(A%)
260     IF A%<32 OR A%=127 THEN PRINT" "; ELSE CALL CRUNCH
270     UNTIL A%=&0D:PRINT
280
290   UNTIL EOF#X
300
310 CLOSE#X
320 PRINT.
330 index=Lastnewline:PROCPoke(&FF):REM FINAL BYTE IN ALL BASIC PROGRAMS 'MUST
BE &FF SO INSERT THIS FOLLOWING LAST RECORDED <CR>
340 REM RESET DEFAULT MESSAGES
350 *OPT
360 PAGE=page:REM SET PAGE TO START OF SALVAGED PROGRAM
370 END
380
390 DEF PROCPoke(B%)
400 page?index=B%
410 index=index+1
420 ENDPROC
```

## UK ERROR LIST

Whilst programs are being written, errors often creep in. I have often wished that the computer would automatically list the incorrect line to speed debugging. This feature is expecially useful to CEGMON/WEMON users with a full screen editor, since the editor could be called immediately rather than after you have had to type LIST xxx.

The program requires alterations to two bytes in order to locate it anywhere in memory.

*R Clarke*

```
ADDR CODE      MNEMONIC
0240  4C 49 53 54 20      ; codes for LIST
0245  A9 50     LDA £$50  ; .0245 G to initialise
0247  A0 02     LDY £$02
0249  85 04     STA $04
024B  84 05     STY $05
024D  4C 00 00  JMP $0000 ; warm start
0250  C9 92     CMP £$92  ; check if A/Y=92/A1
0252  F0 03     BEQ $0257 ; ie, OK message
0254  4C C3 A8  JMP $A8C3
0257  C0 A1     CPY £$A1
0259  D0 F9     BNE $0254
025B  A6 88     LDX $88   ; we are in command mode
025D  E0 FF     CPX £$FF
025F  F0 03     BEQ $0254 ; yes-exit
0261  A2 04     LDX £$04  ; place 'list' in buffer
0263  BD 40 02  LDA $0240,X
0266  95 13     STA $13,X
0268  CA        DEX
0269  10 F8     BPL $0263
026B  A9 FF     LDA £$FF  ; suspend O/P (CTRL/0)
026D  85 64     STA$64
026F  20 5A B9  JSR $B95A ; print line number
0272  E6 64     INC $64   ; resume O/P
0274  A2 FF     LDX £$FF
0276  E8        INX
0277  BD 00 01  LDA $0100,X ; move printed line no
027A  95 18     STA $18,X ; into buffer
027C  D0 F8     BNE $0276
027E  A9 12     LDA £$12  ; PC points to start of
0280  A0 00     LDY £$00  ; buffer
0282  85 C3     STA $C3
0284  84 C4     STY $C4
0286  38        SEC
0287  4C 84 A2  JMP $A284 ; tokenise & list
```

OEM

# OFFICE EFFICIENCY MACHINES LTD

1 Lochaline Street, London W6 9SJ  Tel. 01-741 7211/2/3/4

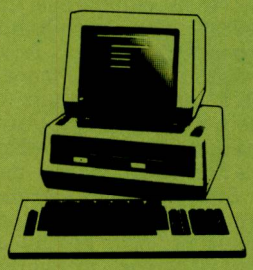
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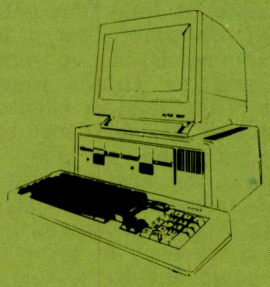
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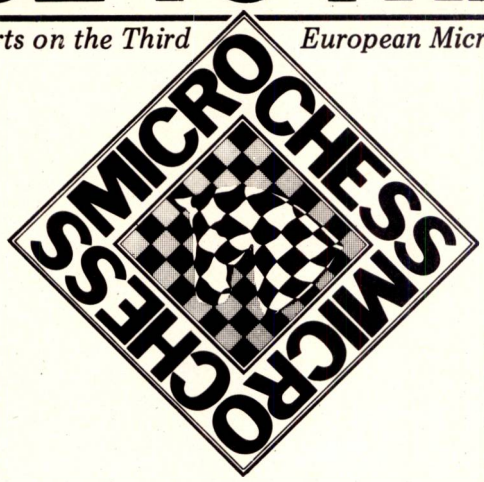
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# ADVANCE TO THE FORE!

*Anthony Harrington reports on the Third European Microcomputer Chess Tournament*




The Third European Microcomputer Chess Tournament, held at the Barbican Centre during the *PCW* Show, proved once again that computer chess is a thriving force.

Despite the fact that entry forms and invitations to the tournament went out later than usual — a consequence of *PCW* itself changing hands and of the withdrawal of David Levy from his accustomed role as tournament organiser — the event attracted a very strong field. There were 14 entries in all, though program failure in the case of two entrants meant that the number of programs involved turned out to be the same as last year, with 12 competing programs.

A seven round Swiss tournament is always an exciting affair, with something of a lottery about it. The basic rule is that players with the same number of wins (or losses) play against each other. The point of this is that the more you win, the harder it gets, since you're meeting people (programs in this case) who've done just as well as you have. If you lose, you have the consolation of being able to expect an easier game next round.

The final line-up included four commercial entries (programs or dedicated chess computers actually on sale to the public or which would be available before the end of the year) and four experimental entries from commercial companies. It might have been even stronger, but Fidelity, of Miami, whose Sensory Chess Challenger '9' is one of the strongest chess computers around, decided against entering a week before the start. (According to John Renaldo, Fidelity's marketing manager, the company was considering entering either a commercial model or an experimental entry or both.) The West German company Hegener and Glaser, which makes the Mephisto, also almost entered, but decided at the last moment that they didn't like Swiss tournaments and would concentrate instead on the US World Championships in March 1984.

One has to sympathise with commercial companies. They have a lot at stake as far as potential sales are concerned. And if their machine, for some reason, failes to win one of the top three placings in a tournament it is tempting for their managing directors to feel that the public will take the hint, and buy the machine which did better.

My own feeling here is that they would do better to compete. If they do feel their commercial model is a little delicate, there's no harm in entering an experimental entry. It would give their programmers a chance to test their ideas, and the results wouldn't affect their market share provided the name given to the experimental entry bore no relation to the market model.

Still, if one remembers that the commercial class in the World Championships, held at Lubeck-Travemunde, West Germany in September last year, consisted of only four entries, one of which withdrew after a few rounds, the commercial line up wasn't bad. And the amateur entries were excellent.

It is the amateur entries that make these events. Unburdened by the financial anxieties of the commercial entrants, the amateurs give the tournament its enthusiastic, convivial atmosphere. Whereas commercial competitors have a tendency to get a little grim at the board and to be sharp and short with opponents, the amateurs tone down the seriousness of it all — and are just as willing to laugh at the odd strange move generated by their own program as they are at their opponent's.

In all there were five amateur entries. From Hamburg, Dieter Steinwender, a computer science student, led a team of four German students with an entry called Micromurks, running on an Apple II. Also on an Apple II was White Knight (Mk 10), written by Martin Bryant. This, like Richard Lang's Cyrus II, running on an Osborne, was an improved version of a program entered into last year's *PCW* tournament. Mark Johnson and Dave Wilson, with Advance 2.4 and Jeff Cooper with Chess '86, also seasoned *PCW* tournament campaigners, completed the amateur turnout.

In passing, one should probably say that the 'amateur status' of several of these programmers simply means that they are not selling or about to sell their entry programs (though they might, if an offer came along). Johnson, Bryant and Lang are all employed by Intelligent Software, a company set up by David Levy and Kevin O'Connell to write and market chess programs (and other 'intelligent' games).

In the experimental commercial class (programs which won't go before the public in their present form), there were two entries by SciSys, the Hong Kong based company whose machine, Mark V, won the Travemunde world championships. These were the Mark 5.01 Experimental and the President Turbo Experimental. The Austrian chess programmer Wim Rens, sponsored by the UK firm Microtrend, entered a program called Gambeit '86 and Intelligent Software put in an entry called Philidor.

The commercial section proper consisted of La Regence, a 'sensory-board' chess computer designed by Intelligent Software; another sensory-board machine, called Bogol, by the Hamburg company Omikron (a newcomer to the commercial chess machine market); Spectrum Chess, which runs on the ZX Spectrum, designed by Artic Computing, and an Irish entry, Conchess, another sensory board machine.

On the morning of 9 September the competitors assembled in the playing area in the Barbican Centre, set up their machines and programs and promptly experienced the first (and, thankfully, the last) major delay of the event. Someone had wired up a plug incorrectly and blew the fuse for that entire floor sector of the Barbican exhibition hall.

Bear in mind the fact that the tournament was part of the *PCW* Show, and hundreds of micro suppliers were putting the finishing touches to their stands while we were hunting for an electrician and you will get a fair picture of the start conditions.

That this was the only electrical problem of the tournament is due in no small part to Gould Electrical Division, Wrexham, who provided power smoothing boxes for every one of the microcomputers in the tournament at the shortest possible notice. The day before the tournament was due to start, the company which had promised to supply power smoothing equipment told us that it was having difficulty with its supplier and wouldn't be able to deliver a single piece of equipment.

We phoned Gould, and the managing director of the branch agreed to provide as much as we needed free of charge and to send a lorryload down in time

# MICRO CHESS TOURNAMENT REPORT

for the tournament the next day, which he duly did. The equipment did its job marvellously and not a single computer in the event had a moment's trouble from power surges or uneven current. Our thanks to Gould for its prompt action.

Play for the whole of this tournament was at the rate of two minutes a move, with the first time control at 30 moves in the first hour and then 23 moves in 46 minutes. This is a somewhat faster rate than is usual in tournament play, but it was forced on us by the tight closing hours of the exhibition. Doors opened for the players and exhibitors at 9.00am (10.00am for the public), and closed at 7.00pm. In order to get through two games a day, we had to limit each round to approximately 3½ hours.

Players were allowed a maximum of 30 minutes down time to rectify any program crashes, so the possible duration of each round was 4½ hours. Since the theoretical starting time for the morning round was 10.00am, and for the afternoon round 2.30pm, a little mental arithmetic will tell you it was a close squeeze fitting both rounds in. Because of the time pressure, it was decided to adjudicate all unfinished games at move 53. This set the tournament director, Stuart Reuben, some complicated adjudication problems in the course of the four days. Fortunately Stuart is a FIDE recognised arbitrator and has years of experience behind him, having directed events such as the Philips and Drew Tournament, the Lloyds Bank Masters, and many other chess competitions.

He was assisted by Peter Morrish, who also provided all the demonstration boards and chess sets at the tournament and did the draw for each round.

The draw and results for the first round were:

| | | | |
|---|---|---|---|
| Advance 2.4 | ½ | Philidor | ½ |
| Spectrum Chess | 0 | Cyrus II | 1 |
| La Regence | 1 | Chess '86 | 0 |
| Gambeit '82 | 0 | President Turbo | 1 |
| Conchess | 1 | Mk 5.01 Exp | 0 |
| Micromurks | 0 | White Knight | 1 |
| Bogol | 0 | (Default) | |

This first round was characterised by two events that looked more like absences than things that would shape the tournament's outcome. Advance 2.4, running on a home constructed bit-slice machine, found itself playing the white side of what must be one of the most boring Benoni defences of all time. Philidor, the opposing program, constructed a blocked middle game in which the best either computer could think of doing was to shuffle rooks back and forth. The programmers read the papers while waiting for the inevitable draw by repetition. Fortunately Advance 2.4 went on to win the next five games in a row, in more aggressive fashion.

While this was going on, the Omikron team of Martin Suhl and Gerd Krey were busy missing the first round. Unfamiliar with London traffic, they'd made the mistake of taking a taxi from Oxford Street instead of a tube. Their program, Bogol went on to win four out of the remaining six games, and who knows, a win in this opening round might have seen them draw level for top commercial entry with La Regence on 5 points.

Second round draw and results:

| | | | | | |
|---|---|---|---|---|---|
| Cyrus II | (1) | ½ | Conchess | (1) | 0 |
| Pres Turbo | (1) | 0 | La Regence | (1) | 1 |
| White Knight | (1) | 0 | Advance 2.4 | (½) | 1 |
| Philidor | (½) | 0 | Bogol | (0) | 1 |
| Mk 5.01 Exp | (0) | ½ | Micromurks | (0) | ½ |
| Chess '86 | (0) | 0 | Gambeit '82 | (0) | 1 |
| A N Other | (-) | ½ | Spectrum | (0) | ½ |

As the keen-eyed will have noted, the tournament had 13 entrants at this stage, though it was soon reduced to even figures for most of the tournament. Chess '86 collapsed during its game against Gambeit '82 and Jeff Cooper only managed to rectify it in time for the final round. The day was exceptionally warm and the Barbican Centre was attracting record crowds. Computers don't like heat and several of them began to show their dislike. One of the SciSys entries, President Turbo, overheated in a complex middle game against La Regence. It was a miracle that the President Turbo started the tournament at all, as Andrew Page, the SciSys UK general manager, only received the module late the previous evening airmail from Hong Kong. Ideally, he would have liked a few weeks to test the program before the tournament, and we had to admire the competitive spirit that chose to enter rather than withdraw under such circumstances.

Round three draw and results:

| | | | | | |
|---|---|---|---|---|---|
| La Regence | (2) | 1 | Cyrus II | (2) | 0 |
| Bogol | (1) | 0 | Advance 2.4 | (1½) | 1 |
| Conchess | (1) | 0 | Pres Turbo | (1) | 1 |
| Gambeit '82 | (1) | 0 | White Knight | (1) | 1 |
| Spectrum | (½) | 0 | Mk 5.01 Exp | (½) | 1 |
| Micromurks | (½) | 0 | Philidor | (½) | 1 |

Richard Lang won last year's tournament and his program, Cyrus II, had looked good up to this point. But La Regence proved too strong. Dieter Steinwender and the German team were becoming very disappointed with their program, which was showing definite flaws.

Round four draw and results:

| | | | | | |
|---|---|---|---|---|---|
| Advance 2.4 | (2½) | 1 | La Regence | (3) | 0 |
| Cyrus II | (2) | 1 | Pres Turbo | (2) | 0 |
| White Knight | (2) | ½ | Mk 5.01 Exp | (1½) | ½ |
| Philidor | (1½) | 1 | Conchess | (1) | 0 |
| Bogol | (1) | 1 | Gambeit '82 | (1) | 0 |
| Spectrum | (½) | 1 | Micromurks | (½) | 0 |

This round produced one of the key games of the competition. La Regence put up a dour struggle against Advance 2.4 and the game went to the 53 move adjudication. But Advance 2.4 was two clear connected passed pawns up in a rook ending and Stuart Reuben had no hesitation in awarding it a win. No one knew it at this stage, but Cyrus II won its last game here, beating President Turbo on adjudication. Reuben had his work cut out in this round, for White Knight and the Mk 5.01 also had to be adjudicated. This last was a very complex position, which either computer could have mishandled with ease. A draw seemed the fairest conclusion.

Round five draw and results:

| | | | | | |
|---|---|---|---|---|---|
| Advance 2.4 | (3½) | 1 | Cyrus II | (3) | 0 |
| La Regence | (3) | 1 | White Knight | (2½) | 0 |
| Pres Turbo | (2) | 1 | Philidor | (2½) | 0 |
| Mk 5.01 Exp | (2) | 0 | Bogol | (2) | 1 |
| Gambeit '82 | (1) | 1 | Spectrum | (1½) | 0 |
| Micromurks | (½) | ½ | Conchess | (½) | ½ |

This round saw White Knight and Philidor falter and lose their way, though Mark Bryant with a final score of 3½ was still to finish strongly enough to take the second amateur placing and a cheque for £50, while Philidor, on 4½, would take third place overall in the tournament.

Round six draw and results:

| | | | | | |
|---|---|---|---|---|---|
| Pres Turbo | (3) | 0 | Advance 2.4 | (4½) | 1 |
| Bogol | (3) | 0 | La Regence | (4) | 1 |
| Cyrus II | (3) | 0 | Mk 5.01 Exp | (2) | 1 |
| Conchess | (1½) | 1 | White Knight | (2½) | 0 |
| Philidor | (2½) | 1 | Spectrum | (1½) | 0 |
| Micromurks | (1) | 1 | Gambeit '82 | (2) | 0 |

The game against Bogol was a stiff test for David Levy's La Regence and it was not without its commercial appeal as well as its chess interest, for both these sensory board machines are due to be marketed before the end of this year.

After this loss, Martin Suhl was undecided whether he was pleased or displeased with his machine's performance. No obvious flaws had been detected and its three wins were very reasonable chess games. In retrospect, the two losses Bogol suffered turned out to be to the machines who came first and second overall, and afer picking up another point in the final round, the German team went home smiling.

Philidor had an easy game against Spectrum, but Richard Turner of Artic Computing thought that the ZX program had held its own well against computers that were very much more powerful. It was only the cassette tape module program in the competition and this is one area where one can expect a greater number of entries next year. Advance 2.4 by this stage looked unstoppable, and it duly crushed President Turbo with a fine mating attack.

Round seven draw and results:

| | | | | | |
|---|---|---|---|---|---|
| Mk 5.01 Exp | (3) | ½ | Advance 2.4 | (5½) | ½ |
| La Regence | (5) | 0 | Philidor | (3½) | 1 |
| Bogol | (3) | 1 | Pres Turbo | (3) | 0 |
| Cyrus II | (3) | 0 | Micromurks | (2) | 1 |
| White Knight | (2½) | 1 | Spectrum | (1½) | 0 |
| Gambeit '82 | (2) | 1 | Conchess | (2½) | 0 |

This final round was full of surprises. The Mk 5.01 played a marvellous game against Advance 2.4, won material in the opening and looked set to force mate by move 26. But Advance 2.4 held on and although two rooks down managed to find a position where it could force perpetual check with its queen — the human equivalent of a 'swindle'.

On board two, meanwhile, the Intelligent Software entries finally came up against each other, and much to everyone's surprise, Philidor, which hadn't done much of note till then, chose that moment to play a complex, crafty game against the fancied La Regence and stopped its stable mate from winning 6 out of 7 games. So although the final round had started with the faint possibility of a tie for first place between La Regence and Advance 2.4 (if the former won while the latter lost), the gods decided otherwise and gave us a clean, clear winner.

Mike Johnson and Dave Wilson took away just about every prize on offer. They won the trophy for overall winner of the Third Microcomputer Chess Tournament, the trophy for the best amateur entry and a cheque for £150. La Regence was named as the best commercial entry in the tournament and Martin Bryant, as we said, collected a cheque for £50 for the second highest placed amateur entrant.

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# PCW SUBSET

*Starting this month, David Barrow, a regular contributor to the series, joins Alan Tootill in presenting more useful assembler-language subroutines. This is your chance to help build a library of general purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed, or translate the implementation of a good idea from one processor to another. PCW will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to Sub Set, PCW, 62 Oxford Street, London W1A 2HG.*

## 6502 arithmetic

Vincent Fojut's last improvement to the 6502 arithmetic routines deals with SBAD46, the 32-bit binary-to-ASCII decimal conversion. There is only a small change in method from the original, printed in February 1982. To save a transfer of the Y to the X register just before label SBD5, the X register holds the number of digits and the Y register holds the bit count, instead of the other way round.

Remember that in 6502 code Sub Set routines have 16 bytes of zero-page RAM reserved for them, designated M0-MF in the mnemonics and ZZ in the machine code. For this suite of routines, the first accumulator is in M0-M3, the second in M4-M7, and the third in M8-MB. MC-MD points to ASCII strings, ME holds the sign of the product of the second and third accumulators, and MF is available as a temporary store.

## Datasheet

```
;=SBAD46 - 32-bit binary to ASCII-decimal conversion
;/CLASS: 2
;/TIME CRITICAL? no
;/DESCRIPTION: Converts a signed 32-bit binary number
;/             to an ASCII-decimal string
;/ACTION Make value absolute.
;/       if negative put "-" to RAM
;/       divide number by ten
;/       put remainder onto stack
;/       increment number of digits
;/       repeat until number=0
;/       pop digit off stack
;/       convert to ASCII and load into RAM
;/       decrement number of entries
;/       repeat until number of entries=0
;/       put ASCII CR inro RAM for terminator
;/SUBr DEPENDENCE: SNEG46
;/INTERFACES: none
;/INPUT: M)-M3 contains the signed 32-bit number for
;/       conversion with the least sig byte atM0 and
;/       the most sig byte at M3
;/       MC-MD contian the RAM start address of the
;/       result
;/OUTPUT: MC-MD are unchanged. The ASCII string result
;/        is in RAM startin at the address given in
;/        MC-MD
;/REGs USED: M0-M3,MC-MD,MF,A,X,Y,P
;/STACK USE: 10 maximum
;/LENGTH: 71
;/T-STATES: 1096 minimum;11202 maximum
;/PROCESSOR:6502
SBAD46:LDY £0     ;RAM point                    A0 00
       BIT M3     ;test sign                    24 ZZ
       BPL SBD1   ;skip if positive             10 08
       LDA £$2D   ;else put"-"                  A9 2D
       STA (MC),y;to RAM                        91 ZZ
       INY        ;point ot next RAM            C8
       JSR SNEG46;and negate number             20 XX XX
SBD1:  STY MF     ;save RAM point               84 ZZ
       LDX £0     ;number of digits=0           A2 00
SBD2:  LDY £32    ;bit count=32                 A0 20
       LDA £0     ;zeroise accumulator          A9 00
SBD3:  ASL M0     ;shift                        06 ZZ
       ROL M1     ;number                       26 ZZ
       ROL M2     ;left                         26 ZZ
       ROL M3     ;into                         26 ZZ
       ROL A      ;accumulator                  2A
       CMP £10    ;is ACC less than 10?         C9 0A
       BCC SBD4   ;skip if so, else             90 04
       SBC £10    ;subtract 10                  E9 0A
       INC M0     ;and set result bit           E6 ZZ
SBD4:  DEY        ;repeat                       88
       BNE SBD3   ;32 times                     D0 EC
       PHA        ;save digit                   48
       INX        ;increment no of digits       E8
       LDA M3     ;check                        A5 ZZ
       ORA M2     ;if number                    05 ZZ
       ORA M1     ;is zero                      05 ZZ
       ORA M0     ;and                          05 ZZ
       BNE SBD2   ;repeat if not                D0 DC
       LDY MF     ;restore RAM point            A4 ZZ
SBD5:  PLA        ;pop digit off stack          68
       CLC        ;convert it                   18
       ADC £$30   ;to ASCII                     69 30
       STA (MC),Y ;and put into RAM             91 ZZ
       INY        ;increment RAM point          C8
       DEX        ;get next                     CA
       BNE SBD5   ;digit, else                  D0 F6
       LDA £13    ;load ASCII carriage return   A9 0D
       STA (MC),Y;into RAM                      91 ZZ
       RTS        ;return                       60
```

It was Dennis May of London SE1 who did the original groundwork on these 6502 arithmetic routines. With Vincent's improvements and the accumulators re-arranged to make the routines fit together better as a package, as suggested by another reader, we have some useful routines that, given enough zero-page RAM, can easily be adapted to cater for numbers of any size. I intend to use them to handle 72-bit binary numbers.

## From one base to another

Dennis May has also sent routines to convert ASCII encoded numbers in one base to ASCII encoded numbers in any other base from 2 to 36. In bases higher than 10, digits with values 10 to 35 are represented by the letters A to Z. There are three routines. The first, given here in Datasheet XBIN, converts ASCII to unsigned 32-bit binary. The second converts 32-bit binary to ASCII, and the third, using the first two, converts ASCII from one base to another. You might like to have a go yourself at the last two, before Dennis's versions are printed — probably in February. (Read on to see what happens in January.)

## Datasheet

```
;=XBIN - convert unsigned base 2-36 number to 32-bit binary
;/CLASS: 2
;/TIME CRITICAL?: no
;/DESCRIPTION: Converts an ACCII base 2-36 number to a
;/             32-bit unsigned binary number
;/ACTION: Clear 32-bit accumulator M0-M3
;/        fetch next digit; if CR then return with C
;/        clear.
;/        Multiply 32-bit accumultaor by base no and add
;/        digit; if overflow, then return with C set
;/        do next digit
;/SUBr DEPENDENCE: none
;/INTERFACES: none
;/INPUT: an ASCII coded number in RAM terminated by 0DH
;/       (carriage return) with digits of values 10-35
;/       represented by the letters A-Z
;/       the address of the ASCII coded number in M@(low)
;/       and M5(high),
;/       the base of the number (between 2 and 36) in M6
;/OUTPUT: for a valid number, CY clear. The 32-bit result
;/        in M0-M3 with the most significant byte in M3
;/        M4-M6 unchanged
;/     for overflow: Cy set. M4-M6 unchanged. M0-M3
;/        indeterminate.
;/REGs USED: A,X,Y,P and M0-MC
;/STACK USE: 2
;/LENGTH: 106
;/PROCESSOR: 6502
XBIN:  LDX £4     ;byte count                   A2 04
       LDY £0     ;index counter                A0 00
XBIN1: STY M0-1,X;clear                         94 ZZ
       DEX        ;accumulator a                CA
       BNE XBIN1 ;                              D0 FB
       STX MC     ;save index counter           86 ZZ
XBIN2: LDY MC     ;load index counter to Y      A4 ZZ
       LDA M4,Y   ;fetch character              B1 ZZ
       CMP £$0D   ;if CR                        C9 0D
       BEQ END    ;then end                     F0 52
       SEC        ;convert                      38
       SBC £$30   ;                             E9 30
       CMP £$0A   ;to                           C9 0A
       BCC ASCY   ;                             90 02
       SBC £7     ;binary                       E9 07
'ASCY: PHA        ;save digit                   48
```

# PCW SUBSET

```
        LDX £4     ;byte count                          A2 04
        LDA £0     ;clear                               A9 00
XBIN3:  STA M6,X   ;accumulator                         95 ZZ
        DEX        ;                                    CA
        BNE XBIN3  ;                                    D0 FB
        LDA M6     ;make copy of base                   A5 ZZ
        STA MB     ;in MB                               85 ZZ
        LDY £8     ;bit count                           A0 08
XBIN4:  ASL MB     ;get bit into carry                  06 ZZ
        PHP        ;save it on stack                    08
        ASL M7     ;shift left accumulator b            06 ZZ
        ROL M8     ;                                    26 ZZ
        ROL M9     ;                                    26 ZZ
        ROL MA     ;                                    26 ZZ
        BCS OVFW1  ;jump if overflow                    B0 1E
        PLP        ;pop bit off stack                   28
        BCC XBIN6  ;skip if bit=0                       90 0E
        LDX £$FC   ;byte pointer                        A2 FC
        CLC        ;                                    18
XBIN5:  LDA M4,X   ;add acc A to acc B                  B5 ZZ
        ADC MB,X   ;                                    75 ZZ
        STA MB,X   ;store result in acc B               95 ZZ
        INX        ;                                    E8
        BNE XBIN5  ;                                    D0 F7
        BCS OVFW2  ;jump if overflow                    B0 09
        INC MC     ;increment pointer index             E6 ZZ
        JMP XBIN2  ;repeat for next digit               4C YY YY
END:    CLC        ;clear carry for OK                  18
        RTS        ;return                              60
OVFW1:  PLA        ;remove data                         68
OVFW2:  PLA        ;from stack                          68
OVFW3:  RTS        ;and return                          60
```

Before any 6502 coders leave us, they might like to look at the Z80 routines that follow, because these are to be given next month in 6502 code. That's what happens in January — or part of it, anyway.

## Send three and fourpence

So runs the amusingly illustrative (and, sadly, out of date) example of what can happen to information passed down the line. It is a problem of no mean consequence in computing, where the integrity of stored or transmitted data is of paramount importance and, naturally, there is a multitude of methods designed to deal with it. Some only indicate that an error has occurred while others can identify the error and thus allow for its correction.

John Kerr of Carmyle, Glasgow brings this important subject to the notice of Sub Set for the first time with the routines ECAL8 and EFIX8, which he says are based on the simplest method of data protection. John also sent ECAL6 and EFIX6, which cannot be included this month for reasons of space, plus an improvement to June's RNDM which saves three bytes and 11 T-states.

ECAL8 produces an error correction byte (ECB) for each data block up to 31 bytes in length. The method could accommodate 32 bytes but, as the ECB is to be appended before transmission or storage, John sensibly sets a limit of 31 data bytes so that the total number of bits of data and ECB is not greater than 256.

The ECB is a parity coding formed by using a parity mask unique to each bit in the data block. The mask is simply the binary number of the position of the bit from bit 0 of the byte following the data. Thus the parity shown in each bit of the ECB is of those data bits which have the corresponding bit set in their position number. For example, bit 5 of the ninth byte from the end would have the position number and parity mask 01001101 where the highest five bits of the mask give the byte number from the end of the block and the lowest three bits give the position of the data bit in that byte. Its parity would be included in bits 0, 2, 3 and 6 of the ECB.

## Datasheet

```
;=ECAL8 - calculate error correction byte
;/CLASS: 1
;/TIME CRITICAL?: no
;/DESCRIPTION: calculates a one-bit error-correction byte
;/              (ecb) to be appended to a data block of 1
;/              to 31 bytes and subsequently used by the
;/              error detect/correct routine EFIX8
;/ACTION: Abort if no. of bytes=0 or GTHAN 31
;/        initialise mask to 8*(no of bytes)+7
;/        clear ecb
;/        for each byte in data block
;/        for each bit in current byte
;/        if bit is 1 then ecb← ecb XOR mask
;/        decrement mask
;/SUBr DEPENDENCE: none
;/INTERFACES:none
;/INPUT: A=no of bytes  HL points to 1st byte
;/OUTPUT: Cy reset: abort
;        Cy set: A=ecb HL points to block+1
;        (ecb can be appended by LD HL,A after the CALL)
;/REGs USED: AF,HL
;/STACK USE: 4
;/LENGTH: 36
;/TIME STATES: 103+332 per byte average
;/PROCESSOR: Z80
ECALB:  AND  A        ;terminate if                     A7
        RET  Z        ;no of bytes+0                    C8
        CP   +32      ;or over 31                       FE 20
        RET  NC       ;                                 D0
        PUSH BC       ;save working registers           C5
        PUSH DE       ;                                 D5
        RLA           ;multiply A by eight              17
        RLA           ;                                 17
        RLA           ;                                 17
        LD   D,+7     ;add 7 for initial mask           16 07
        OR   D        ;using D later as a               B2
        INC  D        ;constant for speed               14
        LD   E,A      ;save initial mask                5F
        XOR  A        ;clear ecb                        AF
NBYTE:  LD   B,D      ;B=8 for bit counter              42
        LD   C,(HL)   ;get byte in C                    4E
NXBIT:  SLA  C        ;shift bit into Cy                CB 21
        JR   NC,SKIPX;and if it is not '1'              30 01
        XOR  E        ;ecb=ecb XOR mask                 AB
SKIPX:  DEC  E        ;next mask                        1D
        DJNZ NXBIT    ;repeat for all bits in byte      10 FB
        INC  HL       ;point to next byte               23
        LD   B,A      ;temp store ecb while             47
        LD   A,E      ;checking for end of block        7B
        CP   D        ;when mask=7                      BA
        LD   A,B      ;get ecb back in A                78
        JR   NC,NBYTE;repeat for all bytes in block     30 EF
        POP  DE       ;restore                          D1
        POP  BC       ;registers                        C1
        RET           ;                                 C9
```

The error detection routine EFIX8 uses ECAL8 to mask, or bit position number, included in the parity of one calculate a new ECB for the received or retrieved data and exclusive-ORs this with the appended ECB to produce a 'correction code' which is the ECB (because the bit was set to '1') but not in the other (because the bit was reset to '0'). If none of the bits are inverted then the correction code will be zero. If error is indicated EFIX8 uses the code to isolate and re-invert the corrupt bit.

## Datasheet

```
;=EFIX8 - detect and correct a one-bit error in data block
;/CLASS: 1
;/TIME CRITICAL?: no
;/DESCRIPTION: examines a 1 to 31 byte data block with
;/              appended ecb and corrects a single bit error
;/ACTION: abort if no of bytes=0 or >31
;/        calculate ecb of data block
;/        XOR with stored ecb to show any difference
;/        if no error then terminate
;/        else use highest five bits to point at corrupt byte
;/        terminating if error in stored ecb indicates
;/        a byte outside data block, use three lowest three
;/        bits to produce bit inversion mask and invert
;/        corrupt bit.
;/SUBr DEPEPDENCE: none
;/INTERFACES: none
;/INPUT: A=no of bytes excluding stored ecb
;/       HL points to first byte
;/OUTPUT: C=no of bytes in block
;/        Cy reset: abort
;/        Cy set: N set: no correction nade HL points to
;/        block + 1
;/                N reset: correction made A= corrected
;/        byte Hl points to corrected byte
;/REGs USED: AF,HL,C
;/STACK USE: 4(including CALL ECALB)
;/LENGTH: 40
TIME STATES: average 360+332 per byte
;/PROCESSOR: Z80
EFIXB:  LD   C,A      ;save no of bytes in block in C   4F
        CALL ECAL8    ;get new ecb of data block        CD XX XX
        RET  NC       ;terminate if ECAL8 aborted       D0
        XOR  (HL)     ;compare new and stored ecb       AE
        CP   +8       ;terminating if                   FE 08
        RET  C        ;no error is indicated            D8
        PUSH BC       ;save B                           C5
        LD   B,A      ;save correction code             47
        RRA           ;divide it by eight to get        1F
        RRA           ;position of                      1F
        RRA           ;corrupt byte                     1F
        AND  1FH      ;from end of block                E6 1F
        INC  C        ;test if position greater than    0C
        CP   C        ;no of bytes in block and         B9
        JR   NC,ESCAP;terminate if error in ecb only    30 11
        LD   C,A      ;move byte position to C          4F
        LD   A,B      ;get three lowest bits of code    78
        AND  07H      ;to give bit pos in byte into A   E6 07
        LD   B,+0     ;move HL to point                 06 00
        SBC  HL,BC    ;at corrupt byte                  ED 42
        LD   B,A      ;using B as count                 47
        INC  B        ; move a '1' into A               04
        XOR  A        ;in the                           AF
        CCF           ;same position                    3F
SHIFT:  RLA           ;as the                           17
        DJNZ SHIFT    ;inverted bit                     10 FD
        XOR  (HL)     ;re-invert it and                 AE
        LD   (HL),A   ;restore it to data               77
ESCAP:  CCF           ;set non-abort flag               3F
        POP  BC       ;restore B                        C1
        RET           ;                                 C9
```

John warns that this method can only cope with at most one bit error in the data block and requires that the ECB be received intact. More than one error will not be detected as such and may result in EFIX8 actually inverting a correct bit. Given this limitation, however, the method is fast and is capable of correcting about 95 percent of errors in a system where the probability of bit error is less than 0.4 percent. It also has a very low redundancy figure of 3.125 percent for a 31-byte block.

## Flag of convenience

I would like to draw your attention to the use of the N flag in EFIX8 to indicate whether a correction has been made or not. The N result is a consequence of the operation immediately prior to exit, and John obviously noticed this fact and used it for speed and shortness in the routine. But it is difficult to test, unlike Cy and Z, which both have a relative jump conditional on their status. Should a Class 1 routine use any flag for passing information or be limited to the easily tested Cy and Z flags?

Flags are also the subject of a letter from K P Leary of Chislehurst, who would like to see the convention Z = OK, NZ = Error used in Sub Set routines, as is used on the TRS-80. Apparently it makes for easier programming than the other way round. He also offers coding to complement the Z flag:

```
PUSH    BC
PUSH    AF
POP     BC
BIT     6,C
POP     BC
```

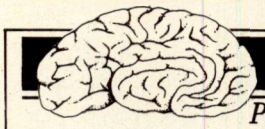
and the Sign and Parity flags:

```
PUSH    BC
PUSH    AF
POP     BC
LD      A,80H (LD A,+2
                for Parity)
PUSH    BC
POP     AF
POP     BC
```

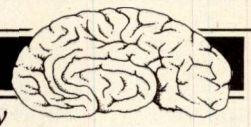
## 8048 keyboard

Since we are touching on interfacing, here is a listing of some 8048 assembler code from Jim Chance of Birmingham. It uses port 1 (P1) to read and debounce a 4 x 4 matrix keyboard. Jim says the 8048 processor is much used commercially and can be found in many products; in, for example, the Tandy Quickprinter 1

```
;P1 0-3 = X drivers
;P1 4-7 = Y receivers routine waits for
;character decode table in ROM
;
KEYBRD:MOV  R7,#0           ;Read 256 times
       MOV  A,#11110000B
       OUTL P1,A            ;Arouse all rows
KEY1:  IN   A,P1
       CPL  A               ;-ve logic
       ANL  A,#11110000B
       JNZ  KEYBRD          ;Start again
       DJNZ R7,KEY1
KEY2:  IN   A,P1
       CPL  A
       ANL  A,#11110000B
       JZ   KEY2            ;Await keypress
       MOV  A,#0
KEY3:  DEC  A
       JNZ  KEY3            ;Delay
       MOV  R7,#KEYCODES    ;Now read
       MOV  R6,#16          ;  16 keys
KEY4:  MOV  A,R7
       INC  R7
       MOVP A,@A
       OUTL P1,A            ;Drive row
       MOV  A,R7
       INC  R7
       MOVP A,@A
       MOV  R5,A            ;Column test
       IN   A,P1
       CPL  A               ;-ve logic
       ANL  A,#11110000B
       XRL  A,R5
       JNZ  KEY5            ;Not found
       DEC  R6              ;0-15 range
       MOV  A,R6            ;Answer in R6 and A
       RET
KEY5:  DJNZ R6,KEY4
       JMP  KEYBRD          ;Illegal
KEYTABLE:                   ;List of 16 pairs
                            ;O3p drive code, i/p test
                            ;  1st =>0 etc
KEYCODES EQU KEYTABLE-$/256*256
X1     EQU  11110000B
X2     EQU  11111101B
X3     EQU  11111011B
X4     EQU  11110111B       ;O/p rows -ve logic
Y1     EQU  00010000B
Y2     EQU  00100000B
Y3     EQU  01000000B
Y4     EQU  10000000B       ;I/p columns +ve logic
       DB   X1,Y1,X1,Y2,X1,Y3,X1,Y4
       DB   X2,Y1,X2,Y2,X2,Y3,X2,Y4
       DB   X3,Y1,X3,Y2,X3,Y3,X3,Y4
       DB   X4,Y1,X4,Y2,X4,Y3,X4,Y4
```



# BRAIN DUMP



*Peter Rodwell reports on some of the lessons the British micro industry could learn from the Japanese*

Mention the Japanese to most people in the micro world in this country and you get some interesting reactions: 'Well, they're very good at cameras and hi-fi but they'll never succeed with computers — they can't produce software, you know.' Or, 'If they were going to get serious about micros they'd have swamped us long ago — guess they're just a bit out of their depth.'

Next month I shall be reporting on my visit to the Tokyo Data Show in October and describing some of the vast wave of Japanese products which will be hitting our shores next year. This month, I'd just like to say a few words about the implications to the UK micro industry of the forthcoming invasion — and make no mistake about it, the Japanese are coming, and they're coming with all the professionalism and dedication which they have already applied to the motorcycle, hi-fi, camera and car markets in this country.

The most striking thing about the new Japanese products is their quality. Quite frankly, they make most British products look crude and utterly amateur by comparison. They are all superbly made examples of skilful production engineering, designed to be mass-produced efficiently and to work reliably. Forget the old chestnut about Japanese products being cheap because they're produced by slave labour — they're not; on average, Japanese factory workers seem to enjoy a standard of living which is at least as high as their British counterparts and frequently higher.

The implications for British (and many American) hardware manufacturers are serious: boys, you'd better pull your socks up fast if you want to stay in this business. The time for good old British complacency is long past; just look at what happened to our hi-fi and motorcycle industries — the same will happen to you if you don't watch out! Even if you can match them on quality, the Japanese are set to fight with prices too — how many British manufacturers are efficient enough to produce a twin-disk, 8086-based, 128k machine with high-resolution graphics, good quality keyboard and a useful amount of applications software for just over £1000 end user price? Or a four-colour A4 plotter at under £90 (yes, ninety pounds) retail? Of course these are the Japanese domestic prices, but even after import duties and freight costs have been added and the price boosted a bit because the British market is traditionally over-priced, there's still a lot of leeway left with which to undercut the market. And don't think that these low domestic prices are gained at the expense of pre- and after-sales backup, either. Even the smallest Japanese computer shop makes the average British equivalent look shamefully pathetic.

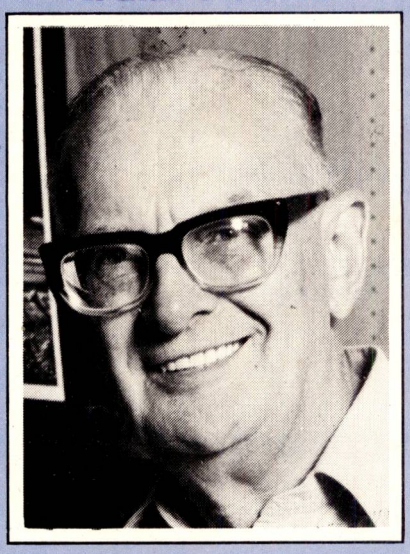
Is there any hope at all for the British micro industry, then, or should we all give up now and start selling (Japanese) video recorders instead? Fortunately, Britain has a hell of a lot to offer the Japanese, mostly in terms of software. Actually, the Japanese are quite good at writing software, but because they plan to hit a wide range of foreign markets virtually simultaneously, the Japanese realise they cannot possibly produce packages tailored to the diverse requirements of each market. They plan instead to commission local software houses to produce suitable packages for each of the various market areas and many of the people I spoke to in Tokyo were well aware of Britain's software expertise. Where we Brits fell down, they told me, was in our reluctance to simply get on a plane and sell our skills abroad — British companies were very noticeably absent from the Data Show.

The coming Japanese invasion will thus be good for our software industry if British software houses act quickly enough — but it has serious implications for our hardware manufacturers unless they can match the Japanese on quality and pricing, and do so very quickly. Regrettably, there will be those who will instead concentrate their efforts on bleating pleas for trade barriers — the barriers won't appear and those who waste time arguing for them instead of getting their acts together are unlikely to last long in this business.

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# "JUST SKIMMED THE LAST THREE ISSUES AND FOUND THEM FASCINATING..."

## Arthur C Clarke



It's amazing what goes on in the basement of *Personal Computer World.* Our erstwhile subscriptions manager, for example, engaging in correspondence with Arthur C Clarke! (For the uninitiated few, ACC is arguably one of the world's most visionary living individuals: a scientist, author of 2001: A SPACE ODYSSEY and 60 or so other works, originator of communications satellites, undersea explorer, etc, etc).

Mr Clarke tells us that he has an Apple II 'languishing in the lab... too busy to touch it for weeks'. Busy, apparently, completing SPACE ODYSSEY two ('my *latest*, last book!') on his Archie word processor (Archives III, 5 megabyte Winchester disk, Wordstar program) with which he is obviously deeply satisfied — 'I could no more imagine going back to a typewriter than to a slide rule...'.

We make no bones about our delight that Mr Clarke takes the trouble to write to us from his home in Sri Lanka and comment on *Personal Computer World* so favourably. As a subscriber to *PCW*, not only will you save a small fortune (see the rates below) but you can count yourself in august company. Remember that Clive Sinclair described *PCW* a short while ago as 'clearly one of the leading computer journals in the world'.

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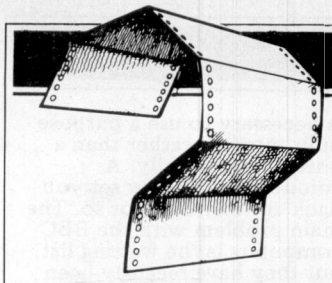
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# COMPUTER ANSWERS

*Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.*



## What's in a name?

**I am considering selling software for my ZX81 but have a query about copyright. If I see a program working on a computer other than the ZX81, and I decide to write a program based on this idea, but using my own programming ideas, is it a breach of copyright if I sell the program?**
*G Smith, Aberystwyth, Dyfed.*

This question is the subject of heated discussion at the moment with the recent threat by Atari to prosecute certain companies who are selling their own representations of Pacman. The question is, can you copyright an idea? If you rewrite a program for the ZX81 then it is very unlikely that it will bear any visual or programming similarity whatsoever, so theoretically you are home and dry. The only point to be careful of is the name, which may be copyrighted. Most companies are very reluctant to allow other companies to benefit from a good name that they have built up.
*James Walsh*

## Forthcoming compiler

**I own a 48k RAM ZX81 and have been reading with interest the articles on Forth which have been appearing in various periodicals recently.**

**I would be very grateful if you could advise me of an address from which I could obtain a Z80 assembly listing of a Forth compiler. I could of course write the I/O routines myself.**
*Chistopher Marriott, Llandudno, Gwynedd*

Forth seems to be a particularly popular language among ZX owners, so Artic Computing decided to write and market a Forth compiler. It is available on EPROM (which needs an extension board to plug into) or cassette,which can be LOADed in the normal way.

More details are available from this address: Artic Computing, 396 James Reckitt Avenue, Hull, HU80 0JA.

For the uninitiated, Forth is another programming language much faster than Basic, closer to the machine, and in some ways easier to learn.

It has such statements as DO-LOOP, BEGIN-WHILE-REPEAT and you can compile your own words. The first computer to use this language as standard is the Jupiter ace.
*James Walsh*

## Cramming it in

**One of the major uses I have for an Osborne 1 is the production of business letters using Wordstar. Although these letters are usually short (typically four or five lines) I keep running out of disk space, due to the limited (92k formatted) capacity of the Osborne's drives. Is there anything I can do about this, short of altering the hardware, with double density, or external drives?**
*Name and address supplied*

Yes, there's a lot you can do.

1. Make sure you have all 92k available for text files (incidentally, that 92k is quite generous for single density single sided disks — about 70k would be more typical) by leaving all the Wordstar and other programs (such as PIP and STAT) on the disk on drive A, and having a blank (but formatted) disk on drive B: on entering Wordstar use the L option to log onto drive B;

2. Once you are happy with the final version of a text file, delete the corresponding .BAK file created by Wordstar. If you are not doing this already, this simple action will double your usable space.

3. The minimum file size on a CP/M 2.2 system such as the Osborne 1 is 2k. Obviously this will limit you to 46 files per disk, even if, as in your case the files are actually much smaller. (There is a further limitation in that the disk directory can only accept 64 entries, but this would only be significant with double-density disks.)

4. This limitation can be overcome by merging lots of your older text files into one bigger file, using either PIP, or the 'Control KR' function in Wordstar. If you use the latter you can arrange for each letter to start on a separate page, so they can be individually printed. If the start of each page includes the letter's reference you can find them in the file using 'Control QF'.

5. Keele Codes Ltd's utility suite 'E40' (See 'Cramming it in' on page 141 of the September 1982 *PCW*) compacts textfiles to approximately 40% of their original size, and now include special options to make it compatible with Wordstar. It is available in Osborne 1 disk format, and my copy came without undue delay.

If your letters were of up to 1k size, and you were not already using any of these ideas, you could get 23 letters (and 23 .BAK copies) on a whole disk. Deleting the .BAK copies would increase this to 46. Merging the letters into bigger files would give a capacity of up to 92. Compressing with 'E40' would increase this to some 230 — a tenfold potential increase.
*P L McIlmoyle*

## Adaptable Sinclair?

**What are the odds that the Sinclair Microdrives in some way can be adapted to other computers?**

**Which is the better of the Z80 and 6502 CPUs in terms of speed and execution repertoire?**

**Approximately how many times faster is a machine code program than one written in interpreted Basic?**

**What are the drawbacks in using 'pageing' to allow an 8 bit CPU to address more than 64k of memory?**
*Bo Nordlin, Sweden*

Without knowing information that is not yet available, any comments on your first point must be no more than informed speculation. Certainly I would expect some type of 'converter boxes' to appear sooner or later, but whether these will come from Sinclair will depend on many factors, including, I would expect, the size of the potential market for these interfaces. There is a move afoot to standardise such 'microdrives' to ensure compatibility from make to make, but Sinclair has a reputation for producing unique products.

The Z80A micro-processor runs at 4 MHz and is thus definitely faster than the 6502. However, much depends on the design and components of the rest of the computer, and even more on the way languages such as Basic are implemented, so while machines with Z80 CPUs are usually faster than those with 6502s this need not be so. The instruction sets of the Z80 and 6502 each have their own devoted followers, and in many regards it is a question of 'horses for courses'. There is a very strong tendency for the Z80 (and related 8080 and 8085) CPUs to be used for business applications and the 6502/6809 to be used for hobbyist/games applications.

The Intel 8080 instruction set can be used also by the Zilog Z80 and the Intel 8085, thus providing interchangeability between programs on these three machines, so long as the extra Z80 instructions are not used.

It is very difficult to give a useful idea of the relative speeds of machine code compared with Basic, as so much depends on the programs in question, as to the number of loops, the amount of I/O, etc. However, a rough idea can be gained from the fact that a fully compiled 'native code' Basic program may well run some 10 to 20 times faster than an interpreted version. In suitable cases (eg, not much I/O) a skillfully written machine code program could improve on this by up to a further order of magnitude.

There are not many drawbacks to 'pageing', which is a useful and powerful technique. However, special memory boards are likely to be required, and special software to use them. There is inevitably some loss of speed due to the extra switching involved. Another snag is that different computers can use different systems of pageing so that the portability of programs written to run under CP/M may well be lost if they use this technique.

You should note that in microcomputers 'pageing' refers to switching from one 'bank' of RAM memory to another, while with mainframes the same word is often used to refer to a technique of dumping the whole contents of memory to disk, and loading a fresh set from disk. Microcomputer disk operations are not yet fast enough for this to be very useful.
*P L McIlmoyle*

## Even KWICer

In September's 'Computer Answers' we were unable to help with 'KWIC query'. However I have just received a letter from P H Catherall of Clwyd, N Wales helping somewhat (many thanks by the way). In case you can't find the original question, here it is:

I have seen a book index produced by a KeyWord

In Context (KWIC) program. Each main word was listed as part of the line of text in which it occurred and the whole index was ordered alphabetically.

Do you know of a KWIC program for a micro, or can you offer any hints for writing my own?
*B Kat, Newcastle-upon-Tyne*

You will find a program to suit your needs in *Software Tools in Pascal* by Kernighan and Planger, Addison-Wesley Publishing Co 1981. ISBN 0-201-10342-7, chapter 4, section 8, page 134 *et seq.*
*SW*

## NEC's question

I want to buy a micro to serve my university needs in maths and electrical engineering, and am thinking of the NEC PC 8001B. Initially I would buy the console and a 12W monitor. Could you comment on: whether or not the NEC is good enough for my needs; if the console will, with cassette storage, give me high resolution graphics without taking up too mch of the 32k RAM; if I should go for NEC's own green monitor, a Hitachi black and white one, or Transtec or BMC green ones.
*J Vella, Marsh, Rep of Malta*

As always, when choosing between machines for a particular application it is helpful to set out a list of the essential features, and then the desirable ones. Comparison of the machine's specifications with this list will help in ensuring a correct decision.

From what you say in your letter I would expect that your list will include the ability to carry out arithmetic to a fairly high precision, and quite rapidly. Also you require a good graphics capability and the ability to handle text up to 80 characters per line.

The NEC 8001B incorporates a version of Basic which provides for double-precision floating point arithmetic, and the CPU is a Z80 equivalent running at 4 MHz, so both these needs should be met. As far as high resolution graphics is concerned, it all depends on what you mean by this. NEC claims a graphics resolution of 160 by 100 points. This should be just as achievable with cassette storage as with disks.

The question of monitors is partly a question of personal taste, and partly one of performance. Good reports are available of the resolution of up to 80 characters per line using both the NEC and the Hitachi monitors. So here the choice may be one of personal preference for green or black and white. For some reason that is a mystery to me, my experience is that office staff tend to prefer green, while technical staff tend to prefer black and white. I am afraid I have no information on the other two monitors you mention.
*P L McIlmoyle*

## Non-xray vision

In the October issue of *PCW* I asked if any reader knew the facts concerning the effects on vision of sitting very close to a colour TV/monitor for long periods. I was particularly concerned about X-rays.

I had many replies, and would like to thank the following for their comments: E H Kelly of Chester, A P Searle of Dulwich, Geoff Cox of Gillingham, A Camacho of St Albans and D J Gazely, the General Secretary of The Partially Sighted Society, for their interesting and helpful responses.

I print here with permission from The Partially Sighted Society an extract from their magazine *Oculus* (May/June '82 issue) which was vetted by one of their advisors, Dr Fergus Campbell MD, FRS of the Department of Physiology at Cambridge University.

'Television sets do not give out any sort of "ray" or other emission that can harm the eyes, even if the viewer's sight is defective and the screen is being viewed from close to. *Although some people may experience a heightened sensation of flicker when watching television from close quarters, which may be unpleasant, this can similarly do no actual harm to the eyes. (If the flicker is too unpleasant, it may be reduced by wearing an inexpensive pair of sunglasses).

'In common with any other visual task, and providing the viewer does not have tunnel vision, moving closer to a television is the simplest of all ways to make the picture easier to see. Moving from ten feet away to a distance of two feet will magnify the picture five times.

'Close viewing like this cannot "strain" or otherwise damage the eyes in any way although the muscles within and around the eyeball, just like any other muscle in the body, may become more quickly tired in these circumstances. If this happens, closing the eyes and resting for a while should relieve any temporary discomfort. (Persistent headaches, or pain in the eye, should of course always receive prompt medical attention.)'

*Reference: Terrana T, Merluzzi F and Guidici E 'Electromagnetic radiations emitted by visual display units,' *Ergonomic Aspects of Visual Display Terminals* (eds: Grandjean E and Vigliani E; London: Taylor and Francis).

Of course, I have no way of checking this, so I publish the extract verbatim.

In return for their article they asked me to ask whether anyone is willing to donate a daisywheel printer compatible with their TRS-80 Level II to the society. If so please contact them on Draycott (03317) 3036.
*SW*

## Happily ever after?

Once upon a time there was a budding microcomputer enthusiast who bought a ZX81. He learnt how to program in Basic on this and was delighted. His main interest began to centre around games and other programs containing moving graphics and thus his ZX81 was no longer good enough. And so, he sold his ZX81 and looked for a better micro in the £300 — £400 range. 'Egad. . .', he cried as he saw the range to choose from.

As it happens, I have the same problem. I am tempted to buy the Sharp MZ-80K, but would really appreciate some advice on which micro to buy, plus some comments on the MZ-80K.
*Mike Swift, Chester-le-Street, Co Durham.*

The number of new 'colour/sound micros' in this and the slightly lower price bracket is increasing almost by the day. Probably the two main ones to look at are the Atari 400 at £319 and the BBC Model B Computer at £399. The Atari is available from Maplin and has probably the best range of games software for any micro in the world. For £319 you get 48k RAM, which is probably the most you will ever use. The BBC Model B has 32k RAM and 16 colour graphics. But you must remember that for really good hi-res graphics it is necessary to use a purpose built monitor rather than a normal colour telly. A colour monitor may set you back another £200 or so. The main problem with the BBC computers is the waiting list, but they have recently been available directly from the address below (among others): Microage Electronics, 135 Hale Lane, Edgware, Middlesex. HA8 9QP. Tel: 01-959 7119.

As far as the MZ-80K is concerned, it doesn't have hi-res graphics or colour and has been overtaken by many of the new computers.
*James Walsh*

## Fuller fun...?

I am the owner of a ZX81 and I am wondering if the Fuller Designs FD system keyboard/case plus a motherboard (so that I can add an interface port as well as the 16k RAM pack), is a good buy, or would I be better off getting a larger computer with 16k+RAM for hobby use?
*N Cooney, Hertford, Cheshire*

The Fuller FD System is a well made and nice looking keyboard and case for your ZX81, though it is reasonably expensive at £39.95. The motherboard is only £15.95, which is pretty good as far as motherboards go. If you can afford to buy another, more expensive computer then go ahead, but for the sake of a nice keyboard and interface port it does seem like a rather unnecessary expense.

Probably the most suitable computer for expansion in this way within the lower price bracket is the BBC Micro, which is £300 for a model A; quite a jump from £49.95. If your main priority is for a computer which has a better Basic and moderately more expansion possibilities then it is worth taking a look at the multitude of new computers which are emerging for around £200.
*James Walsh*



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# How to increase the

Anyone with even a limited knowledge of home computers will instantly recognise the very large advantages of owning a Lynx.

And anyone who truly understands the considerable differences between home computers is likely to have spotted The Lynx a mile off.

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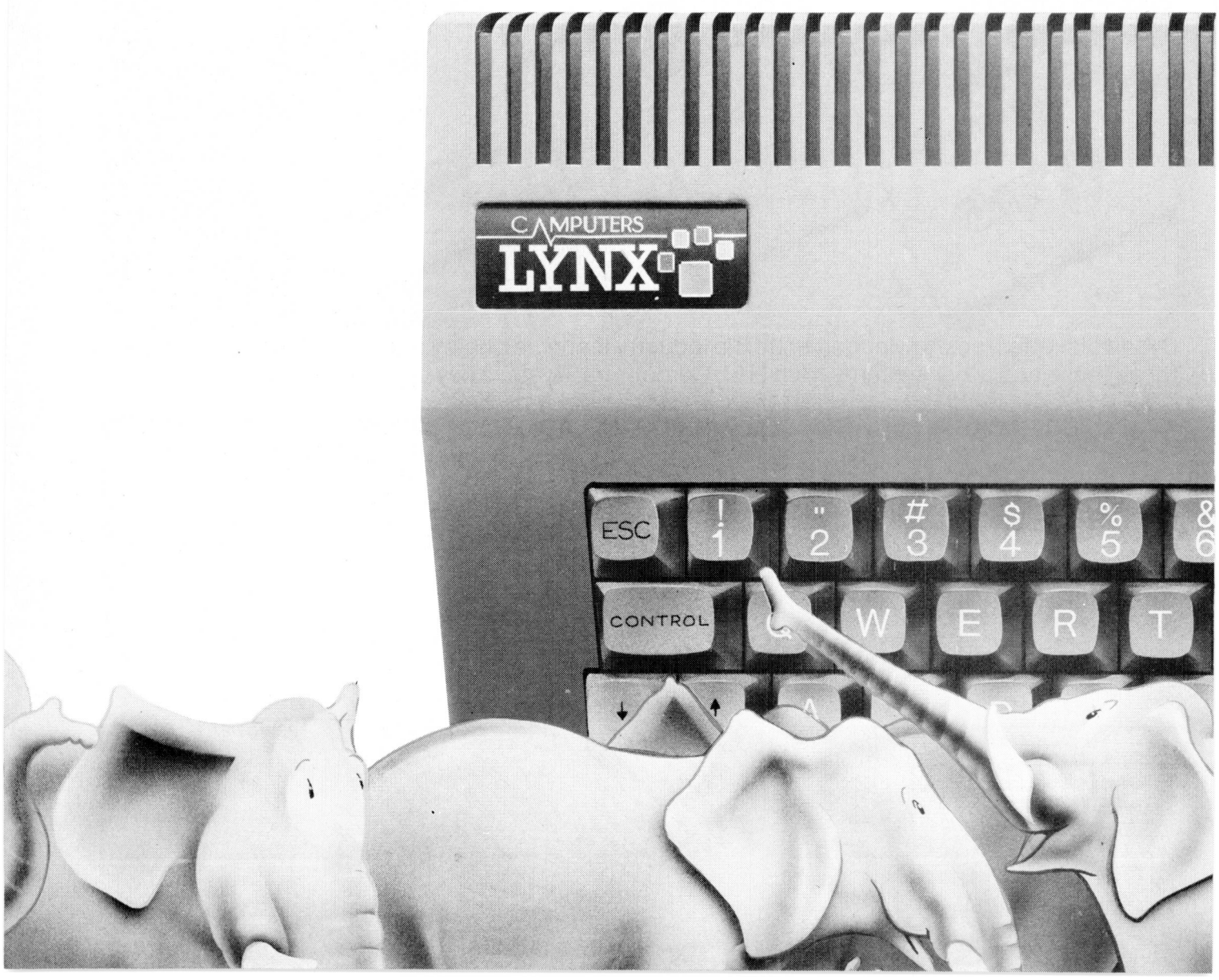
And it is precisely that size of memory which makes The Lynx a superior anim in its field.

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# ize of your memory.

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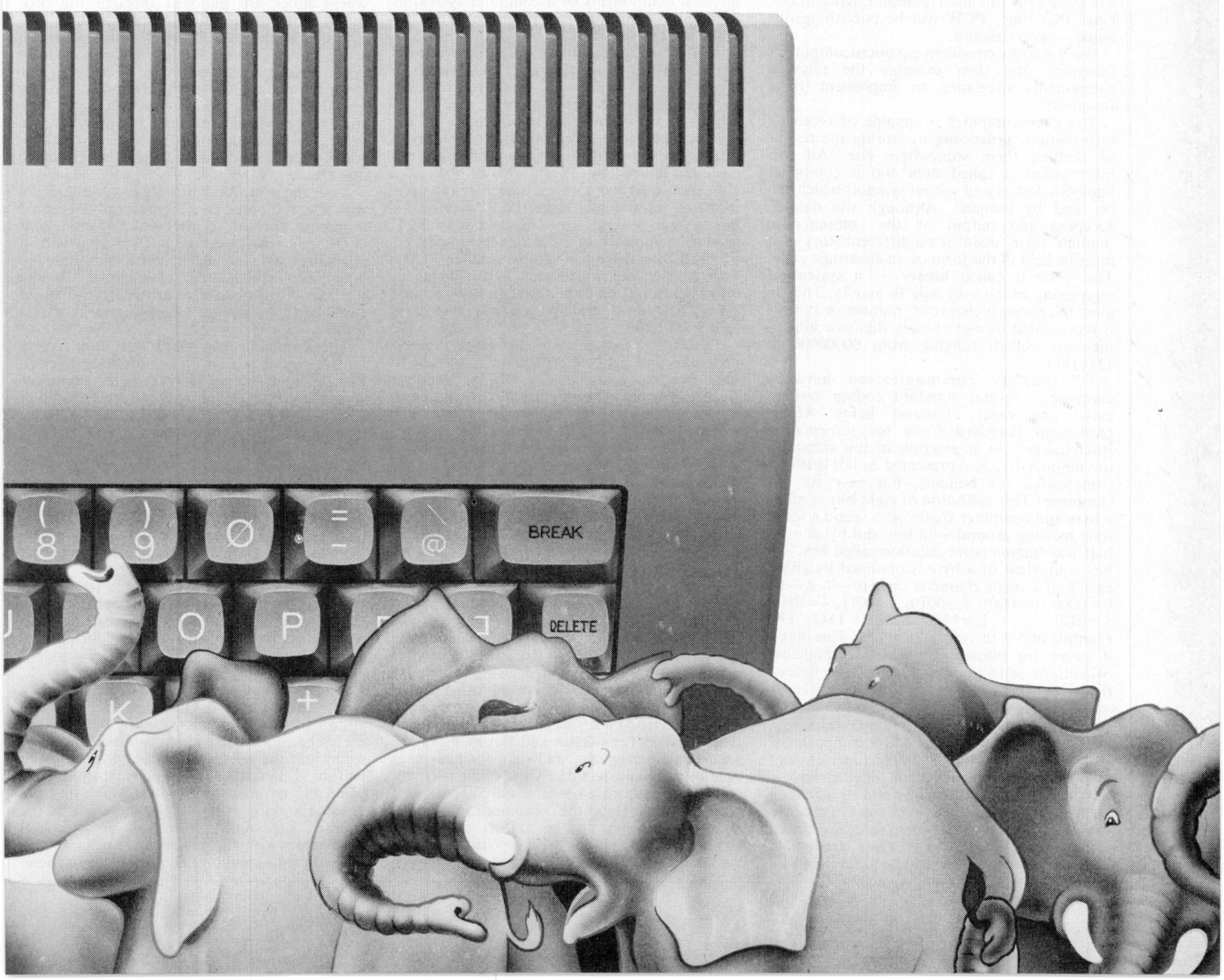
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In other words, you are free to draw in all 8 colours anywhere on the screen.

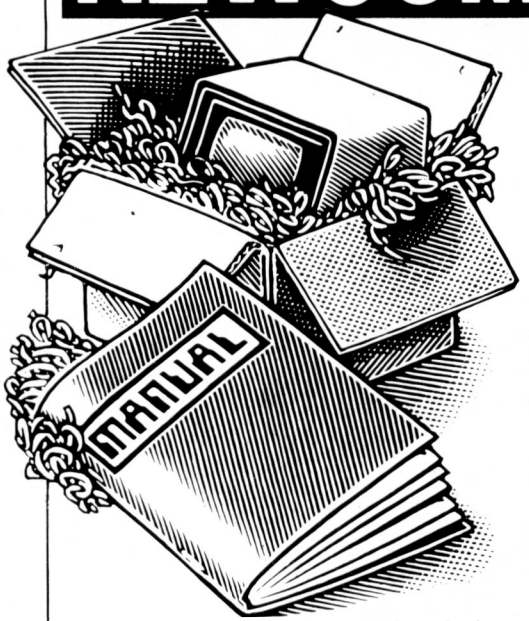
For the full story about The Lynx home computer, write to Camputers Ltd., 33a Bridge Street, Cambridge CB2 1UW and we'll send you a brochure and the name of your nearest stockist.

®CP/M is the registered trade mark of Digital Research Inc.

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# NEWCOMERS START HERE




*This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in* PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex.** The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0 = 0000, 1 = 0001, 2 = 0010, 3 = 0011, 4 = 0100, 5 = 0101 . . . . E = 1110 and F = 1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

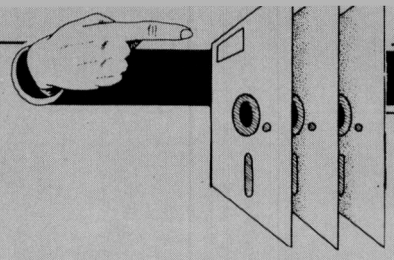
Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



# PACKAGES

*PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to:* **Dick Olney,** *PCW,* **14 Rathbone Place, London W1P 1DE.**

**The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.**
**All details published are the latest made available — some may have changed since this issue went to press.**

| Code | Company | Telephone |
|---|---|---|
| A1 | ACT | 021-454 8585 |
| A2 | Arden Data Processing | 0533 22255 |
| A3 | ADP Network services | 01 388 1912 |
| A4 | Alamo Comp. Serv. | 0642-310381 |
| B1 | B + B Computer Ltd. | 0204 26644 |
| B2 | Beam Business Centre | 061-831-7292 |
| B3 | Benchmark Computer Systems | 0726 61000 |
| B4 | Bristol Software Factory | 0272 23430 |
| B5 | Byte Soft Systems Ltd | 0533 531441 |
| B6 | Business Solutions Ltd | 01-554-5985 |
| B7 | Bromley Computer Consultancy | 01 464 8080 |
| C1 | CAP-CPP Products Ltd. | 01-404 0911 |
| C2 | Commodore | 01-388 5702 |
| C3 | Compsoft | 0483 39665 |
| C4 | Comput-a-crop | 0507-604271 |
| C5 | Computastore Ltd. | 061-832-4761 |
| C6 | Computech | 01-794 0202 |
| C7 | Compass | Standish 426252 |
| C8 | CWP Computers | 01-828 3127 |
| C9 | C4 Computer Services | 0632-664313 |
| C10 | Caxton Software | 01 379 6502 |
| C11 | CBS Consultants | 021-722-8181 |
| C12 | Comp Prog & Systems Serv | 0942-38831 |
| E1 | Engineering Sciences | 01-437-4894 |
| G1 | Graffcom Systems Ltd. | 01-727 5561 |
| G2 | Grama (Winter) Ltd. | 01-636 8210 |
| G3 | Great Northern | 0532 589980 |
| G4 | Alan Greenhalgh Ltd | 01-520-0218 |
| G5 | Grade One | Glossop 63819 |
| H1 | A.J. Harding | 0424 220391 |
| H2 | Hartford Software | 0606 76265 |
| H3 | H.B. Computers | 0536 83922 |
| H4 | Wordcraft Systems | 0332 760127 |
| I1 | Intereurope Software Design | 0734 786644 |
| I2 | Intex Datalog Ltd | 0642 781193 |
| J1 | T.V. Johnson | 0276 20446 |
| K2 | Keen Computers | 0602 412777 |
| L1 | Lifeboat Associates | 01-836 9028 |
| L2 | Liveport (Exidy Sorcerer Firmware) | 0736 798157 |
| L3 | Ludhouse (Computing) Ltd. | 01-679 4321 |
| L4 | Logic Comp Systems | 01-222-1122 |
| M1 | Micro Computer Applications Ltd. | 0734 470425 |
| M2 | Microteck. | Orpington 26803 |
| M3 | Microsys Ltd | 051 426 7271 |
| M4 | Microsave | 0272 737555 |
| M5 | M.A.P. Comp Systems | 061-624-5662 |
| O1 | Omicron Design | 0784 31809 |
| P1 | Padmede Computer Services | 0251 421892 |
| P2 | Personal Computers Ltd. | 01-377 1200 |
| P3 | Professional Computer Services | 061 624 4065 |
| P4 | Prestige Computers | 021 561 2001 |
| Q1 | Quill Computer Systems. | 061 477 4960 |
| R1 | Rockliff | 051-521 5830 |
| S1 | SMG Micro Computers | 0474 55813 |
| S2 | The Softwarehouse | 01-637 2108 |
| S3 | Stage One Software | 0202 735656 |
| S4 | Systematics International | 0440 61121 |
| S5 | Sumlock Bondain | 01-250 0505 |
| S6 | Stemmos | 01 602 6242 |
| S7 | Software Aids Int | 01-904 8139 |
| S8 | SD Micros | 01 836 9520 |
| T1 | Tridata Micros Ltd. | 021 622 6085 |
| T2 | Templeman Software | 0789 66237 |
| T3 | The Micro Solution | 0608 3256 |
| T4 | Terodec Ltd | 0734-664343 |
| T5 | TABS Ltd | 0264-58933 |
| T6 | Tip Data Ltd | 0375-33910 |
| V1 | Vlasak Electronics Ltd. | 0494-448633 |
| W1 | Wisbech Computer Services | 0945 64146 |
| W2 | Westfarthing Comp Services | 03265-4098 |
| W3 | Walters Computer Systems Ltd | 04492 70811 |
| X1 | Xetal | 061 682 7555 |

## Applications

| Application | Machine | Price | Code |
|---|---|---|---|
| Analysis ledger | Philips P2000 | £100 | P4 |
| Appointments planner | Act Sirius 1 | £115 | C7 |
| | Challenger | £25 | C7 |
| Assembler dev | PET/CBM | £50 | L2 |
| Bill of materials | Apple II | £199 | T5 |
| | CP/M | £850 | B5 |
| | CP/M | £199 | T5 |
| | Cromemco | £850 | B5 |
| | PET/CBM | £199 | T5 |
| | Superbrain | £450 | T3 |
| Bookmakers package | CP/M | POR | B7 |
| Budgeting package | Apple II | £125 | P2 |
| | Apple II | £125 | T2 |
| | CP/M | £95 | B5 |
| | Cromemco | £95 | B5 |
| | North Star Horizon | £95 | B5 |
| Building estimating | Apple II | £570 | S8 |
| Bureau de change | PET/CBM | £8 | H3 |
| Cash flow | Apple II | £125 | P2 |
| | Apple II | £80 | V1 |
| | Apple II | £100 | C8 |
| | CP/M | £250 | L3 |
| | CP/M | £95 | B5 |
| | Cromemco | £95 | B5 |
| | North Star Horizon | £95 | B5 |
| Cash register | CP/M | £300 | T4 |
| Cheque writer | CBM/8032 | £90 | P3 |
| | PET/CBM | £90 | P3 |
| Company secretary | CP/M | £450 | C4 |
| Construction cashflow | Apple II | £75 | S8 |
| Construction Expenditure | Apple II | £250 | S8 |
| Construction Financial Control | Apple II | £750 | S8 |
| Construction valuations | Apple II | £500 | S8 |
| Container accounting | CP/M | £750 | M5 |
| Contract costing | Apple II | £500 | P1 |
| | CP/M | £2000 | L3 |
| CP/M & utilities | Tandy Model II | £150 | M1 |
| Credit control | Apple II | £98 | P2 |
| | PET/CBM | £650 | B4 |
| Customer file | Famos | £1000 | M2 |
| Database management/Information retrieval | ACT800 | £225 | H4 |
| | Apple II | £150 | A2 |
| | Apple II | £150 | K2 |
| | Apple II | £60-140 | S2 |
| | Apple II | £150 | S5 |
| | Apple II | £75 | P2 |
| | Apple II | £100 | S4 |
| | Apple II | £100 | C8 |
| | Apple II | £125 | T2 |
| | CP/M | £150-750 | C4 |
| | CP/M | £100 | G3 |
| | CP/M | £350 | B3 |
| | CP/M | £400 | C3 |
| | CP/M | £600 | G5 |
| | Famos | £1500 | M2 |
| | North Star Horizon | £250 | B3 |
| | PET/CBM | £250 | C3 |
| | PET/CBM | £225 | H4 |
| | PET/CBM | £75 | B1 |
| | PET/CBM | £50/150 | C2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | G2 |
| | Superbrain | £300 | S6 |
| | Tandy Model 1 | £25-80 | M1 |
| | Tandy Model 1 | £60 | S2 |
| | Tandy Model 1 | £150 | J1 |
| | Tandy Model 1 | £32.50 | H1 |
| | Tandy Model 111 | £270 | A4 |
| | 8000 Series | POR | C2 |
| Dental Records | Apple II | £395 | M4 |
| | CP/M | £500 | T4 |
| Disk operating system | PET/CBM | £150 | B1 |
| Double glazing costing | North Star Horizon | £750 | W1 |
| Eire payroll system | CP/M | £650 | M5 |
| Estate agent | Apple II | £850 | A2 |
| | Apple II | £850 | S5 |
| | Apple II | £850 | K2 |
| | Apple II | £175 | P2 |
| | Apple II | £130 | C8 |
| | Apple II | £750 | S4 |
| | PET/CBM | £30 | H3 |
| | CP/M | £750 | C4 |
| | CP/M | £700 | B5 |
| | PCC 2000 Simpelec Triton 3 | £350 | B3 |
| | MZ-80K | £195 | W1 |
| | Superbrain | £600 | S6 |
| | Superbrain | £600 | C12 |
| Equipment lease/rent/HP | CP/M | £400 | G1 |
| Expense analysis | Philips P2000 | £150 | P4 |
| File Handling | PET/CBM | £225 | H4 |
| Financial modelling | Act Sirius 1 | £595 | A1 |
| | Apple II | £450 | P2 |
| | Apple II | £360 | C8 |
| | CP/M | £400 | G1 |
| | CP/M | £95 | B5 |
| | CP/M | £425-535 | A1 |
| | CP/M | £400 | B6 |
| | Cromemco | £95 | B5 |
| | North Star Horizon | £95 | B5 |
| | PET/CBM | £425-535 | A1 |
| | RAIR Black Box | POR | A3 |
| Financial planning | Act Sirius 1 | £150 | A1 |
| | Apple II | £250 | S4 |
| General ledger/NL | Apple II | £300 | A2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £455 | P2 |
| | Apple II | £225 | V1 |
| | Apple II | £295 | C6 |
| | Apple II | £250P | S4 |
| | Apple II | £600 | T2 |
| | Apple II | £490 | L4 |
| | Apple II | £199 | T5 |
| | CBM/8032 | £450 | C11 |
| | CBN/8032 | £350 | W3 |
| | CP/M | £500 | L3 |
| | CP/M | £375 | L1 |
| | CP/M | £500 | C4 |
| | CP/M | £400 | G1 |
| | CP/M | £400 | M3 |
| | CP/M | £400 | B5 |
| | CP/M | £275 | S6 |
| | CP/M | £390 | S7 |
| | CP/M | £350 | B3 |
| | CP/M | £300 | W1 |
| | CP/M | £425 | B6 |
| | CP/M | £500 | T4 |
| | CP/M | £400 | M5 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | Cromemco | £400 | B5 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £400 | M3 |
| | PCC 2000 North Star Horion | £400 | B5 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £200 | C2 |
| | PET/CBM | £200 | H3 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £100 | P4 |
| | Sharp PC3201 | £450 | P2 |
| | Superbrain | £400 | M3 |
| | Superbrain | £400 | S6 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | Tandy Model 1 | £225 | H1 |
| | Tandy Model 1 | £225/325 | T1 |
| | Tandy Model 11 | £425 | T1 |
| | Vector | £400 | C5 |
| | 8080/Z80 | £357 | L1 |
| | 8080/Z80 | £275 | G3 |
| General purchase transaction proc. | CBM/8032 | £495 | S3 |
| Hotel billing | Philips P2000 | £500 | P4 |
| Hotel management | Apple II | £525 | M4 |
| | CP/M | £525 | M4 |
| | RAIR Black Box | POR | A3 |
| Incomplete records | Act Sirius 1 | £1200 | S1 |
| | Apple II | £250 | S2 |
| | Apple II | POR | K2 |
| | Apple II | £425 | P2 |
| | Apple II | £450 | P1 |
| | Apple II | £490 | L4 |
| | CBM/8032 | £150 | W3 |
| | CP/M | £750 | M3 |
| | CP/M | £250 | B5 |
| | CP/M | £975 | B3 |
| | CP/M | £750 | W1 |
| | CP/M | £1250 | M5 |
| | CP/M | £155 | C10 |
| | Cromemco | £250 | B5 |
| | North Star Horizon | £750 | M3 |
| | North Star Horizon | £250 | B5 |
| | North Star Horizon | £975 | B3 |
| | Philips P2000 | £150 | P4 |
| | Superbrain | £750 | M3 |
| | Superbrain | £1200 | S1 |
| | Tandy Model 1 | £40 | M1 |
| | Tandy Model 1 | £40 | H1 |
| Industrial cleaning package | CP/M | POR | B7 |
| Industry Factory loading | Apple II | £360 | X1 |
| | CP/M | £360 | X1 |
| | PET/CBM | £300 | X1 |
| Industry work study | Apple II | £990 | X1 |
| | CP/M | £990 | X1 |
| | PET/CBM | £750 | X1 |
| Inn Management | Act Sirius 1 | £185 | C7 |
| Insurance Broker | Act Sirius 1 | £450 | C7 |
| Insurance renewals | CBM/8032 | £1200 | S3 |
| Integrated accts | Act Sirius 1 | £795 | O1 |
| | Altos (CP/M, MP/M) | £300 | B1 |
| | Apple II | £450 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £855 | V1 |
| | Apple II | £600 | T2 |
| | Apple II | £1470 | L4 |
| | Apple II | £300 | W2 |
| | Apple II | £199 | T5 |
| | CBM/8032 | £1500 | P3 |
| | CBM/8032 | 900 | C11 |
| | CP/M | £950 | L1 |
| | CP/M | £1500 | C4 |
| | CP/M | £1100 | G1 |

# PACKAGES

| Application | Machine | Price | Code |
|---|---|---|---|
| | CP/M | £990 | M3 |
| | CP/M | £690 | B5 |
| | CP/M | £900 | B5 |
| | CP/M | £1450 | B3 |
| | CP/M | £1200 | B6 |
| | CP/M | £199 | T5 |
| | Cromemco | £690 | B5 |
| | Cromemco | £900 | B5 |
| | Famos | £2000 | M2 |
| | MZ-80K | £150 | P2 |
| | North Star Horizon | £950 | B3 |
| | North Star Horizon | £690 | B5 |
| | North Star Horizon | £900 | B5 |
| | PET/CBM | £300 | B1 |
| | PET/CBM | £800 | S3 |
| | PET/CBM | £199 | T5 |
| | North Star Horizon | £990 | M3 |
| | PET/CBM | (£50) | C2 |
| | PET/CBM | £650 | J1 |
| | PET/CBM | £650 | G2 |
| | Philips P2000 | £650 | P4 |
| | Superbrain | £990 | M3 |
| | Superbrain | £1200 | S6 |
| | Superbrain | £1000 | T3 |
| | Superbrain | £1200 | S1 |
| | Tandy Model I | £350 | M1 |
| | Tandy Model II | £350 | M1 |
| | Tandy Model I | £75 | J1 |
| | Tandy Model II | £795 | O1 |
| | Tandy Model III | £550 | A4 |
| | Vector | £1000 | C5 |
| | 8000 Series | POR | C2 |
| | 8080/Z80 | £950 | L1 |
| | 8080/Z80 | £995 | G3 |
| Investment portfolio | Tandy Model I | £20 | S2 |
| Invoicing | Act Sirius 1 | £95 | C7 |
| | Act Sirius I | £265 | O1 |
| | Act Sirius I | £195 | A1 |
| | Apple II | £295 | S2 |
| | Apple II | £300 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £140 | V1 |
| | Apple II | £300 | T2 |
| | Apple II | £199 | T5 |
| | Challenger | £25 | C7 |
| | CP/M | £325 | L1 |
| | CP/M | £150-350 | C4 |
| | CP/M | £250 | M3 |
| | CP/M | £250 | S7 |
| | CP/M | £100 | B5 |
| | CP/M | £200 | B3 |
| | CP/M | £300 | W1 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | Cromemco | £100 | B5 |
| | North Star Horizon | £100 | B3 |
| | North Star Horizon | £250 | M3 |
| | North Star Horizon | £100 | B5 |
| | PET/CBM | £350 | A1 |
| | PET/CBM | £25-50 | B1 |
| | PET/CBM | POR | J1 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £150 | P4 |
| | Superbrain | £250 | M3 |
| | Superbrain | £150 | S6 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | Tandy Model I | £25 | H1 |
| | Tandy Model I | £75 | T1 |
| | Tandy Model II | £125 | T1 |
| | Tandy Model II | £265 | O1 |
| | Tandy Model III | £280 | A4 |
| | 8080/Z80 | £325 | L1 |
| Jewellers System | CP/M | £1000 | S7 |
| Job costing | Act Sirius 1 | £350 | C7 |
| | Act Sirius I | £265 | O1 |
| | Apple II | £300 | P1 |
| | Apple II | £990 | X1 |
| | Apple II | £199 | T5 |
| | CBM/8032 | £1000 | C11 |
| | CBM/8032 | £350 | W3 |
| | CP/M | £700 | C4 |
| | CP/M | £350 | M3 |
| | CP/M | £990 | X1 |
| | CP/M | £500 | T4 |
| | CP/M | £650 | M5 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | CP/M | £1500 | T6 |
| | North Star Horizon | £350 | M3 |
| | PET/CBM | £750 | X1 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £400 | P4 |
| | Superbrain | £350 | M3 |
| | Tandy Model I | POR | M1 |
| | Tandy Model II | POR | M1 |
| | Tandy Model II | £265 | O1 |
| Job order control | 8080/Z80 | £275 | G3 |
| Legal precedents | CP/M | £1100 | C4 |
| Letter writer | Apple II | £80 | V1 |
| | Apple II | £99 | T5 |
| | CP/M | £150 | M3 |
| | CP/M | £99 | T5 |
| | North Star Horizon | £150 | M3 |
| | Superbrain | £150 | M3 |
| Local government housing maint | RAIR Black Box | POR | A3 |
| Lotteries | PET/CBM | £45 | H2 |
| Mailing List | Altos (CP/M. MP/M) | £75 | B1 |
| | Apple II | £300 | A2 |
| | Apple II | £50-150 | S2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £40 | P2 |
| | Apple II | £100 | S4 |
| | CP/M | £50-150 | C4 |
| | CP/M | £250 | G1 |
| | North Star Horizon | £195 | W1 |
| | PET/CBM | £45 | H2 |
| | PET/CBM | £15 | A1 |
| | PET/CBM | £75 | B1 |
| | PET/CBM | £35 | H3 |
| | Superbrain | £140 | C9 |
| | Tandy Model 1 | £40 | M1 |
| | Tandy Model II | £75 | M1 |
| | Tandy Model I | £50-150 | S2 |
| | Tandy Model I | £25/38/55 | H1 |
| Mail shot | Act Sirius I | £95 | A1 |
| | Apple II | £14 | S2 |
| | Apple II | £40 | P2 |
| | Apple II | £25 | T2 |
| | Apple II | £99 | T5 |
| | CBM/8032 | £350 | W3 |
| | Challenger | £25 | C7 |
| | CP/M | £200-360 | C4 |
| | CP/M | £90 | M3 |
| | CP/M | £100 | S7 |
| | CP/M | £50/150 | G5 |
| | CP/M | £99 | T5 |
| | MCZ Zilog | £250 | I1 |
| | North Star Horizon | £90 | M3 |
| | PCC 2000 Simplec Triton 3 | £450 | B2 |
| | Superbrain | £90 | M3 |
| | Tandy Model I | £75+ | G4 |
| | Tandy Model II | £75 | M1 |
| | Tandy Model II | £75+ | G4 |
| | Tandy Model III | £160 | A4 |
| Membership accting | Apple II | £75 | P2 |
| | MCZ Zilog | £250 | I1 |
| | PET/CBM | £85 | H2 |
| Motor Dealer | Act Sirius I | £345 | C7 |
| | CBM/8032 | £950+ | P3 |
| | Famos | £5000 | M2 |
| NEDO price adjustment | Apple II | £200 | S8 |
| Order entry/ invoicing | Apple II | £99 | T5 |
| | CBM/8023 | £750 | P3 |
| | CP/M | £350 | G1 |
| | CP/M | £500 | T4 |
| | CP/M | £550 | M5 |
| | CP/M | £550 | L1 |
| | CP/M | POR | B7 |
| | CP/M | £99 | T5 |
| | 8080/Z80 | £550 | L1 |
| Order Processing | AppleII | £99 | T5 |
| | CP/M | £99 | T5 |
| | Philips P2000 | £200 | P4 |
| Office admin | Apple II | £100 | S4 |
| Pad to plotter systems | Apple II | £250 | P2 |
| | Apple II | £180 | C8 |
| Payroll | Act Sirius I | £300+ | O1 |
| | Act Sirius I | £195 | A1 |
| | Apple II | POR | A2 |
| | Apple II | £200 | S2 |
| | Apple II | POR | S5 |
| | Apple II | POR | K2 |
| | Apple II | £200 | P2 |
| | Apple II | £375 | V1 |
| | Apple II | £375 | C6 |
| | Apple II | £250P | S4 |
| | Apple II | £400 | T2 |
| | Apple II | £490 | L4 |
| | Apple II | £199 | T5 |
| | CBM/8032 | £375 | P3 |
| | CBM/8032 | £350 | W3 |
| | Challenger | £24 | C7 |
| | CP/M | £450 | L3 |
| | CP/M | £475 | L1 |
| | CP/M | £495 | C4 |
| | CP/M | £500 | G1 |
| | CP/M | £390 | M3 |
| | CP/M | £500 | B5 |
| | CP/M | £450 | B3 |
| | CP/M | £425 | B6 |
| | CP/M | Lease | W1 |
| | CP/M | £500 | T4 |
| | CP/M | £450 | M5 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | Famos | £1500 | M2 |
| | North Star Horizon | £350 | B3 |
| | North Star Horizon | £390 | M3 |
| | North Star Horizon | Lease | W1 |
| | PET/CBM | £200/350 | C5 |
| | PET/CBM | £50/195 | I2 |
| | PET/CBM | £150 | G2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | C2 |
| | PET/CBM | £10 | H3 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £300 | P4 |
| | Scorcerer | £250 | L2 |
| | Superbrain | £390 | M3 |
| | Superbrain | £400 | S6 |
| | Superbrain | £250+ | T3 |
| | Tandy Model 1 | £249 | M1 |
| | Tandy Model I | £200 | H1 |
| | Tandy Model I | £218 | T1 |
| | Tandy Model II | £375 | T1 |
| | Tandy Model II | £300+ | O1 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £475 | L1 |
| | 8080/Z80 | £275 | G3 |
| | PET/CBM | £150 | G2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | C2 |
| | Sorcerer | £250 | L2 |
| | Tandy Model I | £249 | M1 |
| | TRS-80 | £200 | H1 |
| | TRS-80I | £218 | K1 |
| | TRS-80I | £218 | T1 |
| | TRS-80II | £375 | T1 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £475 | L1 |
| | 8080/Z80 | £275 | G3 |
| Perpetual Inventory | CP/M | £150 | B5 |
| | Cromemco | £150 | B5 |
| Personnel records | Apple II | £98 | P2 |
| | CP/M | £450 | C4 |
| | MCZ Zilog | £400 | I1 |
| | PET/CBM | £85 | H2 |
| Petaid report generator | PET/CBM | £250 | S3 |
| Petsoft programs | PET/CBM | £160 | J1 |
| Postal advertising response package | Apple II | £350 | S2 |
| Price lister | PET/CBM | £12 | H3 |
| Product Management | Act Sirius I | £245 | C7 |
| Production analysis | Apple II | £75 | P2 |
| | CP/M | £700 | C4 |
| | PET/CBM | £300 | B1 |
| Production control | CBM/8032 | £650+ | P3 |
| | PET/CBM | £650+ | P3 |
| Prof appts groups | 8080/Z80 | £275 | G3 |
| Prof appts individ | 8080/Z80 | £220 | G3 |
| Prof client billing | 8080/Z80 | £330 | G3 |
| Programming aids | Apple II | £40 | P2 |
| Property management | CP/M | £450-1000 | C4 |
| | CP/M | £400 | M3 |
| | CP/M | POR | B7 |
| | North Star Horizon | £400 | M3 |
| | Superbrain | £400 | M3 |
| Publishers System | CP/M | £1850 | S7 |
| Purchase ledger | Act Sirius I | £395 | A1 |
| | Apple II | £300 | A2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £295 | C6 |
| | Apple II | £300 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £315 | V1 |
| | Apple II | £250P | S4 |
| | Apple II | £300 | T2 |
| | Apple II | £490 | L4 |
| | Apple II | £199 | T5 |
| | Challenger | £25 | C7 |
| | CBM/8032 | £500 | C11 |
| | CBM/8032 | £350 | W3 |
| | CP/M | £500 | C4 |
| | CP/M | £450 | G1 |
| | CP/M | £500 | L3 |
| | CP/M | £425 | L1 |
| | CP/M | £400 | M3 |
| | CP/M | £400 | B5 |
| | CP/M | £395 | S7 |
| | CP/M | 350 | B3 |
| | CP/M | £300 | W1 |
| | CP/M | £425 | B6 |
| | CP/M | £500 | T4 |
| | CP/M | £400 | M5 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | Cromemco | £400 | B5 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £400 | M3 |
| | North Star Horizon | £400 | B5 |
| | Superbrain | £400 | M3 |
| | Superbrain | £300 | S6 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £300 | B4 |
| | PET/CBM | £200 | C2 |
| | PET/CBM | POR | J1 |
| | PET/CBM | £350 | H3 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £200 | P4 |
| | Sharp PC3201 | £300 | P2 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | Tandy Model I | £225 | H1 |
| | Tandy Model I | £225 | T1 |
| | Tandy Model II | £375 | T1 |
| | Vector | £400 | C5 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £425 | L1 |
| Quotation estimating | Act Sirius I | £125 | C7 |
| | Apple II | £300 | P1 |
| | Philips P2000 | £400 | P4 |
| Recruitment Agency | Act Sirius I | £345 | C7 |
| Reinforcement bar schedule | Apple II | £150 | S8 |
| Renewals ledger | Philip P2000 | P4 | |
| Resource optimiser | Apple II | £295 | C10 |

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| Application | Machine | Price | Code |
|---|---|---|---|
| Sales ledger | Act Sirius I | £395 | A1 |
| | Apple II | £300 | A2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £295 | C6 |
| | Apple II | £300 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £315 | V1 |
| | Apple II | £250P | S4 |
| | Apple II | £300 | T2 |
| | Apple II | £490 | L4 |
| | Apple II | £199 | T5 |
| | CBM/8032 | £500 | C11 |
| | CBM/8032 | £350 | W3 |
| | Challenger | £25 | C7 |
| | CP/M | £500 | C4 |
| | CP/M | £450 | G1 |
| | CP/M | £500 | L3 |
| | CP/M | £425 | L1 |
| | CP/M | £400 | M3 |
| | CP/M | £400 | B5 |
| | CP/M | £365 | S7 |
| | CP/M | £350 | B3 |
| | CP/M | £300 | W1 |
| | CP/M | £425 | B6 |
| | CP/M | £500 | T4 |
| | CP/M | £400 | M5 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | Cromemco | £400 | B5 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £400 | M3 |
| | North Star Horizon | £400 | B5 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £300 | B4 |
| | PET/CBM | £800 | C1 |
| | PET/CBM | POR | J1 |
| | PET/CBM | £200 | C2 |
| | PET/CBM | £350 | C7 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £200 | P4 |
| | Sharp PC 3201 | £300 | P2 |
| | Superbrain | £400 | M3 |
| | Superbrain | £300 | S6 |
| | Superbrain | £199 | T5 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | Tandy Model I | £225 | H1 |
| | Tandy Model I | £225 | T1 |
| | Tandy Model II | £375 | T1 |
| | Vector | £400 | C5 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £425 | L1 |
| S/L, P/L & stock control | Apple II | £900 | P2 |
| | Apple II | £1000 | T2 |
| | CP/M | £1000 | L3 |
| | CP/M | £900 | B5 |
| | Cromemco | £900 | B5 |
| | North Star Horizon | £900 | B5 |
| | Philips P2000 | £950 | P4 |
| Solicitor's complete record accounting | Apple II | £3000 | S2 |
| Solicitor's package | Act Sirius 1 | £1400 | S1 |
| | CBM/8032 | £1400 | S1 |
| | Compucorp | £2000 | Q1 |
| | Superbrain | £1400 | S1 |
| | CP/M | £1250 | M5 |
| Statistics | Apple II | £150 | G3 |
| | Apple II | £100-195 | P2 |
| | Apple II | £140 | C8 |
| | Tandy Model I | £45 | S2 |
| Stock control/ recording | Altos (CP/M, MP/M) | £300 | B1 |
| | Act Sirius I | £265 | O1 |
| | Act Sirius I | £195 | A1 |
| | AppleII | POR | A2 |
| | Apple II | POR | K2 |
| | Apple II | POR | S5 |
| | Apple II | £150 | G3 |
| | Apple II | £80 | S2 |
| | Apple II | £75/300 | P2 |
| | Apple II | £285 | V1 |
| | Apple II | £300 | P1 |
| | Apple II | £500 | S4 |
| | Apple II | £490 | L4 |
| | Apple II | £199 | T5 |
| | CBM/8032 | £175 | P3 |
| | CBM/8032 | £199 | T5 |
| | CBM/8032 | £350 | W3 |
| | Challenger | £25 | C7 |
| | CP/M | £325 | L1 |
| | CP/M | £500-1500 | C4 |
| | CP/M | £350 | G1 |
| | CP/M | £900 | M3 |
| | CP/M | £700 | B5 |
| | CP/M | £550 | B5 |
| | CP/M | £550 | B3 |
| | CP/M | £300 | W1 |
| | CP/M | £500 | T4 |
| | CP/M | £550 | M5 |
| | CP/M | POR | B7 |
| | CP/M | £199 | T5 |
| | Cromemco | £700 | B5 |
| | Famos | £1500 | M2 |
| | MZ-80K | £150 | P2 |
| | North Star Horizon | £450 | B3 |
| | North Star Horizon | £900 | M3 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £195 | I2 |
| | PET/CBM | £300 | B4 |
| | PET/CBM | £15 | A2 |
| | PET/CBM | £300 | B1 |
| | PET/CBM | £150 | C2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | G2 |
| | PET/CBM | £250 | R1 |
| | PET/CBM | £35/25 | H3 |
| | PET/CBM | £199 | T5 |
| | Philips P2000 | £300 | P4 |
| | Sharp PC3201 | £300 | P2 |
| | Superbrain | £900 | M3 |
| | Superbrain | £300 | S6 |
| | Superbrain | £450 | T3 |
| | Tandy Model I | £30-50 | M1 |
| | Tandy Model II | £300 | M1 |
| | Tandy Model I | £48 | S2 |
| | Tandy Model I | £200 | H1 |
| | Tandy Model I | £115 | J1 |
| | Tandy Model I | £200 | T1 |
| | Tandy Model I | £375 | T1 |
| | Tandy Model II | £265 | O1 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £325 | L1 |
| Surveying | CP/M | £500 | T4 |
| TAP business system | PET/CBM | £125 | H2 |
| Text file librarian | Apple II | £125 | S4 |
| Time/cost recording | Act Sirius 1 | £800 | S1 |
| | Apple II | £450 | S2 |
| | Apple II | £300 | P1 |
| | CBM/8032 | £800 | S1 |
| | CP/M | £400 | G1 |
| | CP/M | £200 | M3 |
| | CP/M | £350 | B3 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £200 | M3 |
| | North Star Horizon | £450 | W1 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £300 | B1 |
| | Philips P2000 | £300 | P4 |
| | Superbrain | £200 | M3 |
| | Superbrain | £800 | S1 |
| | Tandy Model I | POR | M1 |
| | Tandy Model II | POR | M1 |
| Travel agency accts | Superbrain | £800 | S6 |
| | Tandy Model I | £225 | G4 |
| | Tandy Model II | £225 | G4 |
| Travel Agents Dairy | Tandy Model I | £100 | G4 |
| | Tandy Model Ii | £100 | G4 |
| Travel Ticket Sales | Tandy Model I | £225 | G4 |
| | Tandy Model II | £225 | G4 |
| Utilities | Apple II | £40 | P2 |
| | Apple II | £20 | C6 |
| | CP/M | £50 | B5 |
| | ITT 2020 | £20 | C6 |
| Utility set | PET/CBM | £78 | H3 |
| Various engineering | Tektronix | | E1 |
| Various thermal insulation industry systems | CP/M | £2000+ | T6 |
| VAT master | PET/CBM | £25 | H3 |
| VAT register | Tandy Model I | £15 | H1 |
| Video hire system | Act Sirius I | £125 | C7 |
| | Tandy Model III | £460 | A4 |
| Video message | Apple | £200 | G3 |
| Warehousing | CBM/8032 | POR | S1 |
| | CBM/8032 | £375 | P3 |
| Word processing | ACT 800 | £375 | H4 |
| | Act Sirius I | £295-325 | A1 |
| | Act Sirius I | £295+ | O1 |
| | Apple II | £60 | S2 |
| | Apple II | £75 | K2 |
| | Apple II | £75 | S5 |
| | Apple II | £75 | A2 |
| | Apple II | £150-300 | P2 |
| | Apple II | £75 | J1 |
| | Apple II | £120 | V1 |
| | Apple II | £180/95 | S4 |
| | Apple II | £30 | C8 |
| | Apple II | £500 | T2 |
| | Apple II | £99 | T5 |
| | CP/M | £150-260 | C4 |
| | CP/M | £400 | G1 |
| | CP/M | £250 | M3 |
| | CP/M | £250 | B6 |
| | CP/M | POR | B7 |
| | CP/M | £99 | T5 |
| | Famos | £500 | M2 |
| | North Star Horizon | £250 | M3 |
| | PET | £85/65/ 40/20 | H2 |
| | PET/CBM | £375 | H4 |
| | PET/CBM | £325 | C5 |
| | PET/CBM | £75/150 | C2 |
| | PET/CBM | £75/150 | J1 |
| | PET/CBM | £75/150 | G2 |
| | PET/CBM | £35 | H3 |
| | Philips P2000 | £230 | P4 |
| | Superbrain | £250 | M3 |
| | Tandy Model I | £50/75 | M1 |
| | Tandy Model II | £175-240 | M1 |
| | Tandy Model I | £30/60/90 | S2 |
| | Tandy Model I | £45/95 | J1 |
| | Tandy Model I | £15 | H1 |
| | Tandy Model II | £295+ | O1 |
| | Vector | £400 | C5 |
| | 8000 Series | £250 | C2 |
| Work In Progress | CP/M | £850 | B5 |

# Machines

| Machine | Application | Price | Code |
|---|---|---|---|
| ACT 800 | Database management/ | £225 | H4 |
| | Word processing | £375 | H4 |
| Act Sirius 1 | Appointments planner | £115 | C7 |
| | Financial modelling | £595 | A1 |
| | Financial planning | £150 | A1 |
| | Incomplete records | £1200 | S1 |
| | Inn Management | £185 | C7 |
| | Insurance Broker | £450 | C7 |
| | Integrated Accts | £495 | A1 |
| | Integrated Accts | £795 | O1 |
| | Invoicing | £95 | C7 |
| | Invoicing | £265 | O1 |
| | Invoicing | £195 | A1 |
| | Job Costing | £350 | C7 |
| | Job Costing | £265 | O1 |
| | Mailing list | £95 | A1 |
| | Motor Dealer | £345 | C7 |
| | Payroll | £300+ | O1 |
| | Payroll | £195 | A1 |
| | Project Management | £245 | C7 |
| | Purchase ledger | £395 | A1 |
| | Quotation Estimating | £125 | C7 |
| | Recruitment agency | £345 | C7 |
| | Sales Ledger | £395 | A1 |
| | Solicitors package | £1400 | S1 |
| | Stock control/recording | £265 | O1 |
| | Stock control/recording | £195 | A1 |
| | Time/cost recording | £800 | S1 |
| | Video hire system | £125 | C7 |
| | Word processing | £295/325 | A1 |
| | Word processing | £295+ | O1 |
| Altos (CP/M, MP/M) | Integrated accts | £300 | B1 |
| | Mailing list | £75 | B1 |
| | Stock control/recording | £300 | B1 |
| Apple II | Bill of materials | £199 | T5 |
| | Budgeting | £125 | T2 |
| | Building estimating | £570 | S8 |
| | Cash flow | £80 | V1 |
| | Cash flow | £75 | P2 |
| | Cash flow | £100 | C8 |
| | Construction cashflow | £75 | S8 |
| | Construction expenditure | £250 | S8 |
| | Construction financial control | £750 | S8 |
| | Construction valuations | £500 | S8 |
| | Contract costing | £450 | P1 |
| | Database management/ information retrieval | £150 | K2 |
| | Database management/ information retrieval | £150 | A2 |
| | Database management/ information retrieval | £60-140 | S2 |
| | Database management/ information retrieval | £150 | S5 |
| | Database management/ information retrieval | £98 | P2 |
| | Database management/ information retrieval | £100 | S4 |
| | Database management | £75 | P2 |
| | Database management | £100 | C8 |
| | Database management | £125 | T2 |
| | Dental records | £395 | M4 |
| | Estate agent | £850 | S5 |
| | Estate agent | £850 | A2 |
| | Estate agent | £850 | K2 |
| | Estate agent | £750 | S4 |
| | Estate agent | £130 | C8 |
| | Financial modelling | £360 | C8 |
| | Financial planning | £250 | S4 |
| | General ledger/NL | £300 | K2 |
| | General ledger/NL | £300 | A2 |
| | General ledger/N/L | £450 | P2 |
| | General ledger/NL | £300 | S5 |
| | General ledger/NL | £225 | V1 |
| | General ledger/NL | £295 | C6 |
| | General ledger/NL | £250P | S4 |
| | General ledger/NL | £600 | T2 |
| | General ledger/NL | £490 | L4 |
| | General ledger/NL | £199 | T5 |
| | Hotel management | £525 | M4 |
| | Incomplete records | POR | K2 |
| | Incomplete records | £250 | S2 |
| | Incomplete records | £450 | P1 |
| | Incomplete records | £450 | P2 |
| | Incomplete records | £490 | L4 |
| | Industry factory loading | £360 | X1 |
| | Industry work study | £990 | X1 |
| | Integrated accts | £885 | V1 |
| | Integrated accts | £450 | P1 |
| | Integrated accts | £300 | P2 |
| | Integrated accts | £600 | T2 |
| | Integrated accts | £300 | W2 |
| | Integrated accts | £1470 | L4 |
| | Integrated accts | £199 | T5 |
| | Invoicing | £295 | S2 |
| | Invoicing | £300 | P2 |
| | Invoicing | £140 | V1 |
| | Invoicing | £300 | P1 |
| | Invoicing | £300 | T2 |
| | Invoicing | £199 | T5 |
| | Job costing | £450 | S2 |
| | Job costing | £990 | X1 |
| | Job costing | £300 | P1 |
| | Job costing | £199 | T5 |
| | Letter writer | £99 | T5 |
| | Mailing list | £300 | K2 |
| | Mailing list | £300 | A2 |
| | Mailing list | £40 | P2 |
| | Mailing list | £50-150 | S2 |
| | Mailing list | £300 | S5 |
| | Mailing list | £100 | S4 |
| | Mailing List | £25 | T2 |
| | Mail shot | £14 | S2 |
| | Mail shot | £225 | P2 |
| | Mail shot | £99 | T5 |

# BERZERK*

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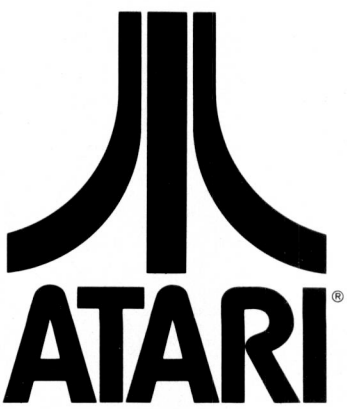
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Write to the attention of: Graham Daubney, Atari International (UK) Inc., 185 Ealing Road, Alperton, Wembley, Middlesex.




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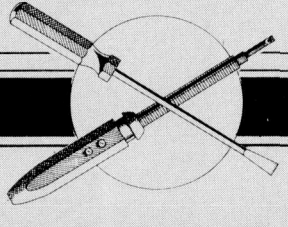
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# PACKAGES

| Machine | Application | Price | Code |
|---|---|---|---|
| | NEDO price adjustment | £200 | S8 |
| | Order entry/invoicing | £99 | T5 |
| | Order Processing | £99 | T5 |
| | Pad to plotter system | £250 | P2 |
| | Pad to plotter system | £180 | C8 |
| | Payroll | POR | S5 |
| | Payroll | POR | K2 |
| | Payroll | POR | A2 |
| | Payroll | £200 | S2 |
| | Payroll | £375 | V1 |
| | Payroll | £200 | P2 |
| | Payroll | £375 | C6 |
| | Payroll | £250P | S4 |
| | Payroll | £400 | T2 |
| | Payroll | £490 | L4 |
| | Payroll | £199 | T5 |
| | Personal records | £75 | P2 |
| | Postal advertising response package | £350 | S2 |
| | Production analysis | £75 | P2 |
| | Programming aids | £40 | P2 |
| | Purchase ledger | £300 | K2 |
| | Purchase ledger | £300 | P2 |
| | Purchase ledger | £300 | A2 |
| | Purchase ledger | £300 | S5 |
| | Purchase ledger | £315 | V1 |
| | Purchase ledger | £300 | P1 |
| | Purchase ledger | £295 | C6 |
| | Purchase ledger | £250P | S4 |
| | Purchase ledger | £300 | T2 |
| | Purchase ledger | £490 | L4 |
| | Purchase ledger | £199 | T5 |
| | Quotation estimating | £300 | P1 |
| | Reinforcement bar schedule | £150 | S8 |
| | Resource optimiser | £295 | C10 |
| | Sales ledger | £300 | A2 |
| | Sales ledger | £300 | K2 |
| | Sales ledger | £300 | S5 |
| | Sales ledger | £300 | P2 |
| | Sales ledger | £315 | V1 |
| | Sales ledger | £300 | P1 |
| | Sales ledger | £295 | C6 |
| | Sales ledger | £250P | S4 |
| | Sales ledger | £300 | T2 |
| | Sales ledger | £490 | L4 |
| | Sales ledger | £199 | T5 |
| | SL, PL stock control | £1000 | T2 |
| | Solicitor's complete record accounting | £3000 | S2 |
| | Statistics | £150 | G3 |
| | Statistics | £100/195 | P2 |
| | Statistics | £100-195 | P2 |
| | Statistics | £140 | C8 |
| | Stock control/recording | £150 | G3 |
| | Stock control/recording | POR | K2 |
| | Stock control/recording | £300 | P2 |
| | Stock control/recording | POR | A2 |
| | Stock control/recording | £80 | S2 |
| | Stock control/recording | POR | S5 |
| | Stock control/recording | £285 | V1 |
| | Stock control/recording | £300 | P1 |
| | Stock control/recording | £500 | S4 |
| | Stock control/recording | £490 | L4 |
| | Stock control/recording | £199 | T5 |
| | Text file librarian | £125 | S4 |
| | Time/cost recording | £450 | S2 |
| | Time/cost recording | £300 | P1 |
| | Utilities | £20 | C6 |
| | Video message | £200 | G3 |
| | Word processing | £75 | K2 |
| | Word processing | £75 | A2 |
| | Word processing | £60 | S2 |
| | Word processing | £300 | P2 |
| | Word processing | £75 | S5 |
| | Word processing | £120 | V1 |
| | Word processing | £75 | J1 |
| | Word processing | £180/95 | S4 |
| | Word processing | £30 | C8 |
| | Word processing | £500 | T2 |
| | Word processing | £99 | T5 |
| CBM/8032 | Cheque writer | £90 | P3 |
| | General ledger/NL | £450 | C11 |
| | General ledger/NL | £350 | W3 |
| | General purpose transaction proc. | £495 | S3 |
| | Incomplete records | £150 | W3 |
| | Insurance renewals | £1200 | S3 |
| | Integrated accts | £1500 | P3 |
| | Integrated accts | £900 | C11 |
| | Job costing | £1000 | C11 |
| | Job costing | £350 | W3 |
| | Mailing list | £350 | W3 |
| | Motor trader | £950+ | P3 |
| | Order entry/invoicing | £750 | P3 |
| | Payroll | £375 | P3 |
| | Payroll | £350 | W3 |
| | Production control | £650+ | P3 |
| | Purchase ledger | £500 | C11 |
| | Purchase ledger | £350 | W3 |
| | Sales ledger | £500 | C11 |
| | Sales ledger | £350 | W3 |
| | Solicitors package | £140 | S1 |
| | Stock control/recording | £175 | P3 |
| | Stock control/recording | £250 | C11 |
| | Stock control/recording | £350 | W3 |
| | Time/cost recording | £800 | S1 |
| | Warehousing | £375 | P3 |
| Compucorp | Solicitors package | £2000 | Q1 |
| Challenger | Appointment Planner | £25 | C7 |
| | Invoicing | £25 | C7 |
| | Mail Shot | £25 | C7 |
| | Payroll | £25 | C7 |
| | Purchase Ledger | £25 | C7 |
| | Sales Ledger | £25 | C7 |
| | Stock Control | £25 | C7 |
| CP/M | Bill of materials | £500 | B5 |
| | Bill of materials | £199 | T5 |
| | Bookmakers package | POR | B7 |
| | Budgeting package | £95 | B5 |
| | Cash flow | £250 | L3 |
| | Cash flow | £95 | B5 |
| | Cash register | £300 | T4 |
| | Company secretary | £450 | C4 |
| | Container accounting | £750 | M5 |
| | Contract costing | £2000 | L3 |
| | Database | £350 | B3 |
| | Database management/ information retrieval | £150-750 | C4 |
| | Database management/ information retrieval | £100 | G3 |
| | Database management/ information retrieval | £400 | C3 |
| | Database management/ information retrieval | £600 | G5 |
| | Dental records | £500 | T4 |
| | Eire payroll system | £650 | M5 |
| | Equipment lease/rent/ HP | £400 | G1 |
| | Estate agents | £750 | C4 |
| | Estate agent | £700 | B5 |
| | Financial modelling | £400 | G1 |
| | Financial modelling | £95 | B5 |
| | Financial modelling | £400 | B6 |
| | General ledger/NL | £500 | L3 |
| | General ledger/NL | £500 | C4 |
| | General ledger/NL | £400 | G1 |
| | General ledger/NL | £375 | L1 |
| | General ledger/NL | £200 | B5 |
| | General ledger/NL | £275 | S7 |
| | General ledger/NL | £400 | M3 |
| | General ledger/NL | £350 | B3 |
| | General ledger/NL | £300 | W1 |
| | General ledger/NL | £425 | B6 |
| | General ledger/NL | £500 | T4 |
| | General ledger/NL | £400 | M5 |
| | General ledger/NL | POR | B7 |
| | General ledger/NL | £199 | T5 |
| | Hotel management | £525 | M4 |
| | Incomplete Records | £250 | B5 |
| | Incomplete Records | £750 | M3 |
| | Incomplete Records | £975 | B3 |
| | Incomplete Records | £750 | W1 |
| | Incomplete Records | 1250 | M5 |
| | Incomplete Records | £155 | C10 |
| | Industrial cleaner package | POR | B7 |
| | Industry factory loading | £360 | X1 |
| | Industry work study | £990 | X1 |
| | Insurance brokers | £995 | W1 |
| | Integrated accts | £1500 | C4 |
| | Integrated accts | £1100 | G1 |
| | Integrated accts | £950 | L1 |
| | Integrated accts | £690 | B5 |
| | Integrated accts | £850 | S7 |
| | Integrated accts | £990 | M3 |
| | Integrated accts | £900 | B5 |
| | Integrated accts | £1450 | B3 |
| | Integrated accts | £1200 | B6 |
| | Integrated accts | £199 | T5 |
| | Invoicing | £325 | L1 |
| | Invoicing | £150-350 | C4 |
| | Invoicing | £150 | S7 |
| | Invoicing | £250 | M3 |
| | Invoicing | £100 | B5 |
| | Invoicing | £200 | B3 |
| | Invoicing | £300 | W1 |
| | Inovicing | POR | B7 |
| | Invoicing | £199 | T5 |
| | Jewellers System | £1000 | S7 |
| | Job costing | £700 | C4 |
| | Job costing | £990 | X1 |
| | Job costing | £350 | M3 |
| | Job costing | £500 | T4 |
| | Job costing | £650 | M5 |
| | Job costing | POR | B7 |
| | Job costing | £199 | T5 |
| | Job costing | £1500 | T5 |
| | Legal precedents | £1100 | C4 |
| | Letter writer | £150 | M3 |
| | Letter writer | £99 | T5 |
| | Mailing list | £50-150 | C4 |
| | Mailing list | £250 | G1 |
| | Mailing list | £75 | S7 |
| | Mail shot | £200-360 | G4 |
| | Mail shot | £90 | M3 |
| | Mail shot | £50/150 | G5 |
| | Mail shot | £99 | T5 |
| | Order entry/invoicing | £350 | G1 |
| | Order entry/invoicing | £500 | T4 |
| | Order entry/invoicing | £550 | M5 |
| | Order entry/invoicing | POR | B7 |
| | Order entry/invoicing | £99 | T5 |
| | Order processing | £550 | L1 |
| | Order processing | £99 | T5 |
| | Payroll | £450 | L3 |
| | Payroll | £495 | C4 |
| | Payroll | £500 | G1 |
| | Payroll | £475 | L1 |
| | Payroll | £500 | B5 |
| | Payroll | £390 | M3 |
| | Payroll | £450 | B3 |
| | Payroll | Lease | W1 |
| | Payroll | £425 | B6 |
| | Payroll | £500 | T4 |
| | Payroll | £450 | M5 |
| | Payroll | POR | B7 |
| | Payroll | £199 | T5 |
| | Perpetual Inventory | £150 | B5 |
| | Personnel records | £450 | C4 |
| | Production analysis | £700 | C4 |
| | Property management | £450-1000 | C4 |
| | Property management | £400 | M3 |
| | Property management | POR | B7 |
| | Publishers system | £1850 | S7 |
| | Purchase ledger | £500 | L3 |
| | Purchase ledger | £450 | G1 |
| | Purchase ledger | £425 | L1 |
| | Purchase ledger | £500 | C4 |
| | Purchase ledger | £200 | B5 |
| | Purchase ledger | £275 | S7 |
| | Purchase ledger | £400 | M3 |
| | Purchase ledger | £350 | B3 |
| | Purchase ledger | £300 | W1 |
| | Purchase ledger | £425 | B6 |
| | Purchase ledger | £500 | T4 |
| | Purchase ledger | £400 | M5 |
| | Purchase ledger | POR | B7 |
| | Sales ledger | £500 | L3 |
| | Sales ledger | £500 | C4 |
| | Sales ledger | £450 | G1 |
| | Sales ledger | £425 | L1 |
| | Sales ledger | £200 | B5 |
| | Sales ledger | £275 | S7 |
| | Sales ledger | £400 | M3 |
| | Sales ledger | £350 | B3 |
| | Sales ledger | £300 | W1 |
| | Sales ledger | £425 | B6 |
| | Sales ledger | £500 | T4 |
| | Sales ledger | £400 | M5 |
| | Sales ledger | POR | B7 |
| | Sales ledger | £199 | T5 |
| | Solicitors | £1250 | M5 |
| | S/L, P/L + stock control | £1000 | L3 |
| | S/L, P/L + stock control | £900 | B5 |
| | Stock control/recording | £325 | L1 |
| | Stock control/recording | £500-1500 | C4 |
| | Stock control/recording | £350 | G1 |
| | Stock control/recording | £500 | B5 |
| | Stock control/recording | £900 | M3 |
| | Stock control/recording | POR | B7 |
| | Stock control | £550 | B3 |
| | Stock control | £300 | W1 |
| | Stock control | £500 | T4 |
| | Stock control | £550 | M5 |
| | Stock control | £199 | T5 |
| | Surveying | £500 | T4 |
| | Time/cost recording | £400 | G1 |
| | Time/cost recording | £200 | M3 |
| | Time ledger | £350 | B3 |
| | Utilities | £50 | B5 |
| | Various thermal insullation industry systems | £2000+ | T6 |
| | Word processing | £400 | G1 |
| | Word processing | £150-260 | C4 |
| | Word processing | £250 | M3 |
| | Word processing | £250 | B6 |
| | Word processing | POR | B7 |
| | Word processing | £99 | T5 |
| | Work in progress | £850 | B5 |
| Famos | Customer file | £1000 | M2 |
| | Data base | £1500 | M2 |
| | Integrated accts | £2000 | M2 |
| | Motor dealer | £5000 | M2 |
| | Payroll | £1500 | M2 |
| | Stock control | £1500 | M2 |
| | Word processing | £500 | M2 |
| MCZ Zilog | Mail shot | £250 | I1 |
| | Membership accting | £250 | I1 |
| | Personnel records | £400 | I1 |
| MZ-80K | Estate agent | £195 | W1 |
| | Integrated accounts | £150 | P2 |
| | Stock control/recording | £150 | P2 |
| North Star Horizon | Budgeting package | £95 | B5 |
| | Cash flow | £95 | B5 |
| | Database management/ information retrieval | £250 | B3 |
| | Double glazing costing | £750 | W1 |
| | Estate agent | £750 | B5 |
| | Financial modelling | £95 | B5 |
| | General ledger/NL | £250 | B3 |
| | General ledger/NL | £400 | M3 |
| | General ledger/NL | £400 | B5 |
| | Incomplete records | £750 | M3 |
| | Incomplete records | £250 | B5 |
| | Incomplete records | £975 | B3 |
| | Integrated accts | £950 | B3 |
| | Integrated accts | £990 | M3 |
| | Integrated accts | £690 | B5 |
| | Integrated accts | £900 | B5 |
| | Invoicing | £100 | B3 |
| | Invoicing | £250 | M3 |
| | Invoicing | £100 | B5 |
| | Job costing | £350 | M3 |
| | Letter writer | £150 | M3 |
| | Miling List | £195 | W1 |
| | Mail shot | £90 | M3 |
| | Payroll | £350 | B3 |
| | Payroll | £390 | M3 |
| | Payroll | Lease | W1 |
| | Property Management | £400 | M3 |
| | Purchase ledger | £250 | B3 |
| | Purchase ledger | £400 | M3 |
| | Purchase ledger | £400 | B5 |
| | Sales ledger | £250 | B3 |
| | Sales ledger | £400 | M3 |
| | Sales ledger | £400 | B5 |
| | SL, PL + stock control | £900 | B5 |
| | Stock control/recording | £450 | B3 |
| | Stock control/recordng | £900 | M3 |
| | Time/cost recording | £250 | B3 |
| | Time/cost recording | £200 | M3 |
| | Time/cost recording | £450 | W1 |
| | Word processing | £250 | M3 |
| PCC 2000 Simpelec Triton 3 | Estate Agent | £350 | B2 |
| | General ledger/NL | £350 | B2 |
| | Mail Shot | £450 | B2 |
| | Purchase ledger | £350 | B2 |
| | Sales ledger | £350 | B2 |
| | Stock control/recording | £350 | B2 |
| | Time/cost recording | £350 | B2 |
| PET/CBM | Assembler dev | £50 | C2 |
| | Bill of materials | £199 | T5 |
| | Bureau de change | £8 | H3 |
| | Cheque writer | £90 | P3 |
| | Credit control | £650 | B4 |
| | Database management/ information retrieval | £75 | B1 |

# PACKAGES

| Machine | Application | Price | Code |
|---|---|---|---|
| | Database management/ information retrieval | £50/150 | C2 |
| | Database management/ information retrieval | £150 | G2 |
| | Database management/ information retrieval | £150 | J1 |
| | Database management/ information retrieval | POR | C1 |
| | Database management/ information retrieval | £225 | H4 |
| | Database management/ information retrieval | £250 | C3 |
| | Disk operating system | £150 | B1 |
| | Estate agent | £30 | H3 |
| | File handling | £225 | H4 |
| | General ledger/NL | £200 | C2 |
| | General ledger/NL | £1000 | C1 |
| | General ledger/NL | £200 | H3 |
| | General ledger/NL | £199 | T5 |
| | Industry factory loading | £300 | X1 |
| | Industry work study | £750 | X1 |
| | Integrated accts | £300 | B1 |
| | Integrated accts | £(50) | C2 |
| | Integrated accts | £650 | G2 |
| | Integrated accts | £650 | J1 |
| | Integrated accts | £800 | S3 |
| | Integrated accts | £199 | T5 |
| | Invoicing | POR | J1 |
| | Invoicing | £25-50 | B1 |
| | Invoicing | £400 | C1 |
| | Invoicing | £199 | T5 |
| | Job costing | £750 | X1 |
| | Job costing | £199 | T5 |
| | Lotteries | £45 | H2 |
| | Mailing list | £75 | B1 |
| | Mailing list | £45 | H2 |
| | Mailing list | £35 | H3 |
| | Membership accting | £85 | H2 |
| | Payroll | £150 | G2 |
| | Payroll | £150 | J1 |
| | Payroll | £150 | C2 |
| | Payroll | £50/195 195 | I2 |
| | Payroll | POR | C1 |
| | Payroll | £200/350 | C5 |
| | Payroll | £10 | H3 |
| | Payroll | £199 | T5 |
| | Personnel recors | £85 | H2 |
| | Petsoft programs | £160 | J1 |
| | Petaid report generator | £250 | S3 |
| | Prise lister | £12 | H3 |
| | Production analysis | £300 | B1 |
| | Production control | £650+ | P3 |
| | Purchase ledger | £200 | C2 |
| | Purchase ledger | POR | J1 |
| | Purchase ledger | £1000 | C1 |
| | Purchase ledger | £300 | B4 |
| | Purchase ledger | £350 | H3 |
| | Purchase ledger | £199 | T5 |
| | Sales ledger | POR | J1 |
| | Sales ledger | £200 | J1 |
| | Sales ledger | £300 | B4 |
| | Sales ledger | £800 | C1 |
| | Sales ledger | £350 | H3 |
| | Sales ledger | £199 | T5 |
| | Stock control/recording | £150 | C2 |
| | Stock control/recording | £300 | B1 |
| | Stock control/recording | £150 | G2 |
| | Stock control/recording | £150 | J1 |
| | Stock control/recording | £195 | I2 |
| | Stock control/recording | £15 | A2 |
| | Stock control/recording | £300 | B4 |
| | Stock control/recording | £35/25 | H3 |
| | Stock control | £199 | T5 |
| | TAP business system | £125 | H2 |
| | Time/cost recording | £300 | B1 |
| | Utility set | £78 | H3 |
| | VAT master | £25 | H3 |
| | Word processing | £75/150 | J1 |
| | Word processing | £75/150 | G2 |
| | Word processing | £75/150 | C2 |
| | Word processing | £85/65 £40/20 | H2 |
| | Word processing | £375 | H4 |
| | Word processing | £325 | C5 |
| | Word processing | £35 | H3 |
| PET/ Computhink | Stock control/recording | £250 | R1 |
| Philips P2000 | Analysis ledger | £100 | P4 |
| | Expense Analysis | £150 | P4 |
| | General ledger/NL | £100 | P4 |
| | Hotel billing | £500 | P4 |
| | Incomplete records | £150 | P4 |
| | Integrated accts | £650 | P4 |
| | Invoicing | £150 | P4 |
| | Job costing | £400 | P4 |
| | Order Processing | £200 | P4 |
| | Payroll | £300 | P4 |
| | Purchase ledger | £200 | P4 |
| | Quotation Estimating | £400 | P4 |
| | Renewals ledger | £200 | P4 |
| | Sales Ledger | £200 | P4 |
| | S/L, P/L stock control | £950 | P4 |
| | Stock control/recording | £300 | P4 |
| | Time/cost recording | £300 | P4 |
| | Word processing | £230 | P4 |
| RAIR Black Box | Financial modelling | POR | A3 |
| | Hotel management | POR | A3 |
| | Local government housing maint. | POR | A3 |
| Sharp PC-3201 | General ledger | £450 | P2 |
| | Sales ledger | £300 | P2 |
| | Purchase ledger | £300 | P2 |
| | Stock control | £300 | P2 |
| Sorcerer | Payroll | £250 | L2 |
| Superbrain | Bill of materials | £450 | T3 |
| | Database | £300 | S6 |
| | Estate agent | £800 | S6 |
| | Estate agent | £600 | C12 |
| | General ledger | £400 | M3 |
| | General ledger | £400 | S6 |
| | Incomplete Records | £750 | M3 |
| | Incomplete Records | £1200 | S1 |
| | Integrated accts | £1200 | S6 |
| | Integrated accts | £990 | M3 |
| | Integrated accts | £1000 | T3 |
| | Integrated accts | £1200 | S1 |
| | Invoicing | £250 | M3 |
| | Invoicing | £150 | S6 |
| | Job costing | £350 | M3 |
| | Letter writer | £150 | M3 |
| | Mailing list | £140 | C9 |
| | Mail shot | £90 | M3 |
| | Payroll | £400 | S6 |
| | Payroll | £390 | M3 |
| | Payroll | £250+ | T3 |
| | Property management | £400 | M3 |
| | Purchase ledger | £300 | S6 |
| | Purchase ledger | £400 | M3 |
| | Sales ledger | £300 | S6 |
| | Sales ledger | £400 | M3 |
| | Sales ledger | £199 | T5 |
| | Solicitors package | £1400 | S1 |
| | Stock control | £300 | S6 |
| | Stock control | £900 | M3 |
| | Stock control | £450 | T3 |
| | Time/cost recording | £800 | S1 |
| | Time recording | £200 | M3 |
| | Word processing | £250 | M3 |
| | Travel agency accts | £800 | S6 |
| Tandy Model I | Database management/ information retrieval | £25-80 | M1 |
| | Database management/ information retrieval | £270 | A4 |
| | Database management/ information retrieval | £60 | S2 |
| | Database management/ information retrieval | £32.50 | H1 |
| | Database management/ information retrieval | £150 | J1 |
| | General ledger/NL | £90 | M1 |
| | General ledger/NL | £90 | M1 |
| | General ledger/NL | £225 | H1 |
| | General ledger/NL | £225/325 | T1 |
| | General ledger/NL | £425 | T1 |
| | Incomplete records | £40 | M1 |
| | Incomplete records | £40 | H1 |
| | Invoicing | £90 | M1 |
| | Invoicing | £280 | A4 |
| | Invoicing | £90 | M1 |
| | Invoicing | £75 | T1 |
| | Invoicing | £125 | T1 |
| | Invoicing | £265 | O1 |
| | Integrated accts | £350 | M1 |
| | Integrated accts | £550 | A4 |
| | Integrated accts | £350 | M1 |
| | Integrated accts | £75 | J1 |
| | Integrated accts | £795 | O1 |
| | Investment portfolio | £20 | S2 |
| | Invoicing | £25 | H1 |
| | Job costing | POR | M1 |
| | Job costing | POR | M1 |
| | Job costing | £265 | O1 |
| | Mailing list | £40 | M1 |
| | Mailing list | £75 | M1 |
| | Mailing list | £25/38/ 55 | H1 |
| | Mailing list | £50-150 | S2 |
| | Mail shot | £75+ | G4 |
| | Mail shot | £160 | A1 |
| | Mail shot | £75 | M1 |
| | Mail shot | £75+ | G4 |
| | Payroll | £249 | M1 |
| | Payroll | £200 | H1 |
| | Payroll | £218 | T1 |
| | Payroll | £375 | T1 |
| | Payroll | £300+ | O1 |
| | Purchase ledger | £90 | M1 |
| | Purchase ledger | £90 | M1 |
| | Purchase ledger | £225 | H1 |
| | Purchase ledger | £375 | T1 |
| | Purchase ledger | £375 | T1 |
| | Sales ledger | £90 | M1 |
| | Sales ledger | £90 | M1 |
| | Sales ledger | £225 | H1 |
| | Sales ledger | £225 | T1 |
| | Sales ledger | £375 | T1 |
| | Statistics | £45 | S2 |
| | Stock control/recording | £30-50 | M1 |
| | Stock control/recording | £300 | M1 |
| | Stock control/recording | £200 | H1 |
| | Stock control/recording | £48 | S2 |
| | Stock control/recording | £115 | J1 |
| | Stock control/recording | £200 | T1 |
| | Stock control/recording | £375 | T1 |
| | Stock control/recording | £265 | O1 |
| | Travel Agency Accts | £225 | G4 |
| | Travel Agency Accts | £225 | G4 |
| | Travel Agents Dairy | £100 | G4 |
| | Travel Agents Diary | £100 | G4 |
| | Travel Ticket Sales | £225 | G4 |
| | Travel Ticket Sales | £225 | G4 |
| | Time/cost recording | POR | M1 |
| | Time/cost recording | POR | M1 |
| | VAT register | £15 | H1 |
| | Video hire system | £460 | A4 |
| | Word processing | £50/75 | M1 |
| | Word processing | £175-240 | M1 |
| | Word processing | £45/95 | J1 |
| | Word processing | £15 | H1 |
| | Word processing | £30/60/ 90 | S2 |
| | Word procesing | £295+ | O1 |
| Vector | General ledger/NL | £400 | C5 |
| | Integrated accts | £1000 | C5 |
| | Purchase ledger | £400 | C5 |
| | Sales ledger | £400 | C5 |
| | Word processing | £40 | C5 |
| 8000 Series | Database management/ information retrieval | POR | C2 |
| | Integrated accts | POR | C2 |
| | Payroll | £250 | C2 |
| | Purchase ledger | £250 | C2 |
| | Sales ledger | £250 | C2 |
| | Word processing | £250 | C2 |
| 8080/Z80 | General ledger/NL | £275 | G3 |
| | General ledger/NL | £375 | L1 |
| | Integrated accts | £950 | L1 |
| | Integrated accts | £995 | G3 |
| | Invoicing | £325 | L1 |
| | Job order control | £257 | G3 |
| | Order processing | £550 | L1 |
| | Payroll | £475 | L1 |
| | Payroll | £275 | G3 |
| | Prof appts groups | £275 | G3 |
| | Prof appts individ | £220 | G3 |
| | Prof client billing | £330 | G3 |
| | Purchase ledger | £425 | L1 |
| | Purchase ledger | £275 | G3 |
| | Sales ledger | £275 | G3 |
| | Sales ledger | £425 | L1 |
| | Stock control/recording | £325 | L1 |
| | Stock control/recording | £275 | G3 |



# ACC NEWS

*Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.*

Well, did you enjoy the *PCW* Show this year? It was of course a great success — there were people everywhere and lots of exciting new products. Many thanks must go to *PCW*, as sponsors, and to Montbuild who do all the work, for a really first class job.

As is becoming a regular practice, the exhibition organisers set up a 'Clubs Area', where the computer clubs were given free stands, administrated via the ACC. This was also a great success, though a slight drawing error caused the club area to be smaller than was intended. Nevertheless, the clubs proved to be a major attraction and therefore show how an exhibition can be enhanced by having club stands. The administration of all this was expertly handled by ACC Secretary David Annal, who once again solved all the problems and smoothed over all the difficulties. Many thanks to you David, and keep it up!

Apart from the various National User Groups, the ACC itself had a stand at the show, and this proved to be quite popular, since there was a PET animated graphics display running. Many thanks to David Annal and his co-authors for writing the 'film' — it was great! Also on that stand was the customary ACC clubs database, which we used to put people in touch with their local clubs. Unfortunately, due to Peter Whittle, our leader and Chairman, being on holiday, we inadvertently ran an out-of-date copy of the database for the first two days. Sorry — we'll slap Peter's wrist shortly.

Also at the *PCW* Show was the Electronic Insight Micronet stand. This was the launch of their new Prestel subscription service, which

will be a closed user group, membership of which includes a very simple Prestel adaptor. The 8008 area which was discussed on last month's ACC News will be involved with this, and there seems to be a lot of scope for clubs to put up information on the Prestel system, as well as opportunities for telesoftware. Watch this space (and Electronics Insight, *800#) for more details.

As is becoming customary at the large exhibitions, there was a meeting of the National User groups and part of the ACC committee. I didn't make it myself 'cos I was talked into running the stand but it was apparently very constructive, both in terms of the discussion of the clubs area at this *PCW* Show and terms of the general policy of the ACC performing a liaison role as the national body for microcomputer enthusiasts. The meeting was felt to be quite useful as a means for the various groups to communicate, as well as the formal consideration of the role that the groups wished the ACC to play.

Anyway, many thanks again to *PCW* for an excellent show, and to 'Uncle' David Annal for his work.

## Exhibition news

On Saturday and Sunday 11/12 December, there will be a Christmas Microfest 82 exhibition at the University of Manchester, Insitute of Science and Technology (UMIST). There was a similar exhibition during the summer at UMIST, and this one promises to be even more of a success. The ACC will be there with our now-infamous database running; we are also going to be organising the club stands.

Also on Microfest is an ACC free seminar, 'Your micro on the dog and bone (or how to whistle at 300 baud)'. This will be an elementary discussion of data communications, using the telephone network. So if Prestel makes you go *†††††** or if mailboxes makes you return to sender, then this talk is for you!

## ACC things

*ACCumulator* now has a new editor. All material for inclusion in *ACCumulator* should be sent to Leon Heller, 8 Morris Walk, Newport Pagnell, Bucks, MK16 8QD. You don't know what *ACCumulator* is all about? Well, write to me and I'll tell you. Let's have lots of contributions flooding in to Leon.

One or two of you out there haven't renewed your ACC subscriptions: I suggest you pay up soon, or the boys will be round to chew your UARTS off. So you say you lost the form . . . well we have plenty to spare at the head office.

The ACC's new hobby is 'regionalisation'. The rules of the game are that you pick on some group of local computer clubs minding their own business, and you introduce them to each other and form an Association. This association then arranges club stands at exhibitions, joint events, speaker lists, etc, and the various clubs in the association generally help each other. The first regional association was the ALCC, and recently the ACC has set up a North Western group (Manchester area). We now want to extend the idea around the country, and I would be very grateful to hear from anybody running clubs around the country who wants to associate. I am in the process of setting up a 'West of London' association of computer clubs, which would cover the area bounded by London, Milton Keynes, Northampton, Oxford and round to Reading and possibly Guildford. Anyway, please can we have some feedback on all this.

The ACC is also keen to help those setting up computer clubs, and I have a literature kit that may be of some help to club builders. Please, please make sure that you inform the ACC of the details of the club, as our database is widely recognised as *the* list of computer clubs, and your club will miss out on a lot of members and information if we don't know about you. It costs absolutely nothing for your group to be entered on the ACC database, apart from the cost of a stamp to write to Peter Whittle, 49 Bartlemas Road, Oxford OX4. Please also tell us about any errors or out-of-date information — quote the reference number on the top of your entry if possible.

## Club bits

I have to report that there has been a military coup at OPeCC. A junta led by Maj-Gen Len Phelps has taken over control of the club while the previous leadership has been variously imprisoned or banished to the ACC committee (which is worse. . .?). All correspondence to the Chairman of the Revolutionary Council, Len Phelps, Southport Cottage, Sutton Courtenay, Abingdon OX14 4AN.

There is a flourishing computer club in Aylesbury, the Aylesbury Computer Club or ACC for short (I know the ACC is wonderful, but did they really have to name their club after us?). Contact: Ken Knight, 22 Mount Street, Aylesbury.

Also it's about time I gave a plug to the West London Personal Computer Club or WLPCC for short. They meet on the first Tuesday of the month —ring Graham Brain on 01-997 8986 for more information.

Also wanting a plug is the Southampton Amateur Computer Club (SACC). It is now five years old and has a membership of over 100. They are associated with a club in Fareham and Portsmouth. The SACC meets second Wednesday monthly at 7.30pm in the Medical Science Building, Bassett Crescent East, Southampton. More info is available from Paul Blitz, 'Gardenways', Chilworth Tower, Chilworth, Southampton (or phone Soton (0703) 766161).

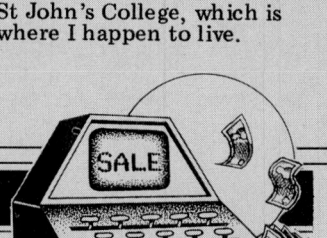
Also brought to my notice is the 'Community Computing Network'. This is a national association of 'voluntary, community and trade union' computing groups. Their aims are similar to the ACC's, except that they are more interested in the specific area of community/trade union computer clubs, as opposed to the general kind that is the main part of the ACC's interest. In addition they have two aims that are *not* like the ACC's — namely:

1) To promote the socially responsible use of the new technology;
2) To provide an education forum for groups interested in the implications of the new technology ;

so I suspect that you would only be welcome if you were ideologically sound. Anyway, if you are interested, contact The Community Computing Network, c/o CODA, 135a Mansfield Road, Nottingham NG1 3FQ.

If you have any queries about any of the information in ACC news, or wish to find out about the ACC, then please contact me: Rupert Steele, ACC Membership Secretary, St John's College, Oxford, OX1 3JP.

NB: You must put my name on the envelope, as the ACC is not associated with St John's College, which is where I happen to live.




# TRANSACTION FILE

*Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for co-operating.*

✱ 16K ZX81 — PSU, leads, manual and 32 bit i/o board, (for sound, control, etc.) also software; QS DEF, ZXAS, Scramble, + more. Only £85.00 excellent condition, 2, Barton Rise, Chilton Polden, Bridgwater, Som. Tel. (0278) 722588 E/W.Ends.

✱ TRS80 Level 2 — 16k VDU cassette recorder manuals, dozens of games, adventures, utilities, scripsit, Edtasm, Tasmon, worth £850 accept £350 (includes delivery). Tel. Mr Williamson 0733 63141 ext. 570 during daytime.

✱ ZX81 and 16k RAM — Also many m/code games including Asteroids, Defender. Plus book wi with over 40 programs, plus 5 issues of 'Sinclair User'. Will accept £80 ono. Telephone: Worksop 770887.

✱ 48k Nascom2 — Gemini 64k/ EROM cards. Romed, Zeap2.1, Nasdis, Debug, Ext-Basic. Colour. H.R.G. 4k 8 tape. 8Apsu. Vero case. Enormous software library. Eprom prog. £725.00. P. Smith, 23 Sandy Close, Petersfield GU31 4HF. 0730 4059.

✱ Video Genie EG3003 — 16k hardly used, condition as new, £180 ono. Tel. 01-440 9498.

✱ Knights super machine — code tape, includes free space invaders. (for Sharp MZ-80k) Excellent value the best at only £25 (worth nearly £40). Phone Mr Morris on Wrexham (0978) 365875 after 4p.m.

✱ PET 3032 — 32k, Tookit, chip. Cassette recorder. Many program tapes, magazines and Pet manuals. All excellent condition. £400 ono. Near Wolverhampton. Tel: Codsall 2341.

✱ UK101 8k RAM — cased with number pad, 300/600 baud switch, many programs, cassette and T.V. £300 ono. Will swap for 8k RAM small keyboard pet. Phone Welwyn Garden City 35949 after 4pm.

✱ Apple II — plus single disk manuals, programs including database £925. Also Sharp MZ80k 120 programs. Documentation. Dustcover £325 Tel. Stratford upon Avon 298187 (Weekends).

✱ Nascom-2 — 32k kenilworth case, 5 card expansion rack, Easicomp sound board, software toolkit, Vortex (graphics), Assembler, £400 ono. Phone D. Keeling 051-709 0516 (daytime).

✱ Superboard II . . . — 16k, two monitors, power supply, cased, 6-inch television, all leads, basic 5, Toolkit, enhanced screen, 12k Rom, manuals, newsletters, games, including invaders, Assembler Editor. £125 ono. Telephone: 01-897 0620.

✱ Acorn Atom — 6k RAM, 8k RO ROM +PSU, Manual, leads, seven programme cassettes (educational and games). Ready to run. Ideal for learner. £90 ono (plus carriage). Nicholls, 01-670 8605 (evenings).

✱ Sharp Mz80k — 48k RAM excellent condition £250 reason for sale upgrade Tel 0705 811760.

✱ ZX81-1k, Sinc built, inc all leads and adaptor, original packing, manual and PSU. Exc condition. £40 tel: 01-883 0085, after 6pm.

✱ Sharp MZ80k — 48k, excellent condition, (boxed) dust cover, £200 worth software inc. chess, adventures, forth and assembler. Green and blue screens £440. St. Albans 65580.

✱ Tandy microprinter — electrostatic type. 80 column facility. 3 type sizes — centronics interface. Boxed 1 unused with roll of paper Need money for discs. £100. Tel. 021-444 4954 evenings/weekends.

✱ Apple II+ — 48k autostart ROM disc drive with controller, 9in Hitachi monitor, EPSON FX80/FT Epson interface, Applewriter, Microchess, Toolkit, manuals etc. £1,100 ono. Tel. 0226 297610 after 6pm. Reluctant sale!!!

✱ MZ-80k — +48k + £350 +£200 worth of games + forth fortran pas Pascal and super 5060 VM. Basic must sell soon: £350 ono (unwanted present). Tel. Frodsham 33978 after 4.00, anytime weekend.

✱ MZ-80k Software — Frogger 8k long; £4. Dogfight 2 player graphics game, 7k long £3.50 48k

# TRANSACTION FILE

Adventure 20+ full screen pictures £5, 6k Disassembler £4. Mr G.W. Smith, 7, St Davids Grove, Birmingham B20 1BT.

✱ UK101 — 8k RAM, new monitor, cased, inc leads, manual and programs. 300/600 Baud, under 1 year old. £150 ono. Tel: 01-529 5325.

✱ Centronics 308 — Dot matrix printer with manual and some spares suit heavy duty application £320. Tel. Ely (0353) 778846 evenings.

✱ Seikosha GP100 — graphic printer, as new £185. Tex Eprompt U.V. Eraser plus 2716 Eproms £20 Tel. Watford 48505 evenings/week ends.

✱ Atari VCS — inc five cartridges Combat, Space Invaders, Breakout, Lazer Blast, Asteroids, £150. ZX81 plus PSU and Casio FX501P, Library, Interpack and master pack £100 ono. 01-556 0395.

✱ Acorn Atom — 12k Rom 12k Ram I/O ports. Carefully built and maintained by professional engineer. User manual all leads home-made power supply £185. Tel 368 9023 evenings.

✱ 48k Sorcerer . . .— with basic Rompack, development Pac and 9" Hitachi Monitor. Various software, Forth, Chess, Asteroids, etc. Also including manuals leads and club magazines. £675 ono. Tel: Brighton 557757.

✱ TRS80 16k Lower-case — £225. 16k expansion interface unused £200. Aculab floppy tape £125. Buy the lot and get Edtasm, Scripsit, Pyramids, Sargon, Monitor3, all for £50. Phone: Chelmsford 329541.

✱ TRS80 48k monitor — twin disks IBM golfball printer, centronics 779 printer, newdos+, Ldos, sales ledger, Superzap. Many more progs. £750 might split. Tel. 01-637 4135 daytime Lea Valley 714209(evenings).

✱ BBC Micro Model B — avoid the queue. Various software: Invaders, space — Warp, Toolkit, etc. Joystick, user Port, etc. £380 ono. Tel: Horley (029-34) 4405.

✱ HP-41C/V Card Reader — complete with manual and 15 cards. As new. £110. Tel: 66-51462 after 7pm. 5, Lansdowne Avenue, Orpington, Kent. BR6 8JT.

✱ Tangerine Microtan, Tanex,— 2Kram, Xbug, Basic, Apple Keyboard. Worth £250. £150 ono. includes 8 issues. Tug newsletter. Tel 01-977 9540 after 6.

✱ Apple software at half price. — 7 original Apple Games Programs for sale at half price. Phone Terry on 0782 564561.

✱ ZX81 Sinc built — with 16k RAM Manual leads mains adaptor book and cassettes worth £30 including 3D monster maze and asteroids £75 ono. Telephone Great Missenden 5098 evenings and weekends.

✱ VIC 20 — with commodore cassette unit, mains adapter, R.F. modulator and about fifteen programs six months old. As new £190. Phone Glenboig 874204 (after 5pm).

✱ Video Genie System — EG3003 with some software £210 ono. Phone 01-251 0959 evenings.

✱ TRS80-LII 32k — Exp/int. Num/Keypad, single Tandy mini disk drive, Tandy VII printer, Zend/and script sit. Offers! ASR33 ASCII Terminal 110 Baud 20mA tape Punch Reader, Handbooks, stand £130. Worthing 501425.

✱ Acorn Atom — fully expanded with PSU and VIA chip + invaders and chess programs. £195. Panasonic cassette recorder with leads to work with Atom £20. London SW1 Tel. 01-730 7065.

✱ TRS80 16k L2 with VDU PSU cassette recorder manuals 1/2 various books on games instructions and 24 cassettes including 'sound' 'Music master' etc. One owner home use as new £380. Tel. Bagshot 71902.

✱ CBM/PET system 8032 — 8050 950k dual disk drive, 3022 tractor printer; complete with cables, manuals Visicalc. Mint condition (50 hours use only). House purchase forces sale hence cash price £1500. Tel: (01) 452 8020 ext 389. (9-5) R.G.Ormerod.

✱ PET 3032 — 202 printer Computhink, 400 disk-drive Data-base, many games assembler and toolkit programes. All for £675 ono. Also 2001 series Pet with many games plus second cassette deck — £260 ono or both. £910. Telephone David 01-940 2077.

✱ Casio FX702P — unwanted present in original box manuals etc £70 ono. Upper Warlingham 5737.

✱ ITT 2020 with 3.3 disc drive many extras including jail-break, type-right, 64k memory and masses of software. £800 or offer. 01-864 3492 evenings and weekends.

✱ Commodore 4040 — twin disc drives and 3022 printer. V.G.C. littel used. Includes original packi packing cables manuals etc. £750 the pair O.V.N.O. phone 202-9630 (work) 953 5900 (home).

✱ Sharp MZ-80k — 48k, Perfect condition. Cover, software, forth, and basic. Basic tutor book, subscription to users group, programs inc. The Valley and Space Invaders. Price £310 ono. Tel. Walsall 26201.

✱ ZX81 and 16k RAM — mains adaptor, leads and manual all £100.00 ono. Andy Field. Daytime 09328-66777 evening 01-570 7724 (Hounslow).

✱ PET 32k — new ROM, L/keyboard, superchip, tookit assembler, reset switch, cassette recorder with sound tapecounter. 20 tapes; asteroids, cosmiads, s/glooper, 3-d Startrek, microchess etc. Manuals dust-cover v.g.c. 4495. Tel. Burley (Hants) 2294.

✱ Video Genie I — EG3003 16k new keyboard and display functio functions with sound some software books manuals £250. Tel. 01-309 2086 Sidcup Kent even.

✱ Triton — computer 11k RAM, basic and editor assembler in Eprom, metal case and many extras. Cheam Surrey, Tel. 01-642 1359, after 6.30 pm, £200 o.n.o.

✱ TRS80 LII — 16k complete with monitor and CTR80 recorder — As new £350.00 ono. Tel. Birmingham (021) 443 5399.

✱ Sharp MZ-80K 48K — with £300 worth software including assembler, machine code, Forth, Fortran, Pascal, Invaders, Adventures and many others. Worth over £600. Sell for £350 Phone: (0834) 813021 after 4.

✱ "WORD PACK" — Rom by Acornsoft Ltd for Acorn ATOM. Fits utility ROM socket. If you have a printer you need this fast wordprocessor. £17. B. Carroll, 42 Manor Rd, Aldershot. GU11 3DG. 0252-22539.

✱ BBC Model B — unused £395 ono. Tel. Chester 534462 6 weeks old. Why wait for ages when you can buy mine. Reason for selling have bought business system instead.

✱ UK101 8k — cased Cegmon, MONO2, 600/300 Baud, Fan, Osi, assembler, manuals. Much software one year old: £175 phone Leicester (0530) 32563 after 6pm.

✱ Wanted Televideo — Terminial service manual model TVI-912. £15.00 paid for good copy or original. Call Rodney on 0705 731478 or write to Rodney 75 St Ronans Road, Southsea, Hnts PO4 0PP.

✱ TRS80 Model I (Level II) — CPU wanted for spare parts or repair any condition considered. Offers phone Derby (0332) 550408 evenings or weekends.

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✱ 8k PET 2001 — new ROM, large keyboard, + cassette + superchip + manusl + dust cover + 50 programs £4.00 ono. Tel: 052 789 3204.

✱ Apple II 48k — £400 Monitor £25. Cards — Centronics £80 serial £50, colour/Modulator £50, language £70 disk/controller £250 Software — Visicalc £80, Applewriter £30 Database £20, numerous games £50. Brookwood 6196.

✱ Sixteen Atari — and three Activision cartridges for sale very good condition. Includes Pac- Man, Missile command, asteroids. Cost owner £500 will accept £250. Phone Norwich 411089 weekdays between 7pm-9pm.

✱ Sharp Mz-80k 48k Green screen. Languages: Assembler, Machine, Basic. Knight, command commander, m/c loader, disassembler, +115 programs worth £400. All only £500 o.n.o. Tel. Poole (0202) 678947.

✱ Video Genie — 16k inc VU Meter etc. Complete with leads, TRS-80 manual plus other books etc. Genuine reason for sale £100 or exchange for reasonable printer. 01-592 3000 ext 2165 day 03756-79533 evenings.

✱ Atari 400 — 32k (normally £60 extra, also Atari 410 tape recorder, full technical manuals, asteroids, star raiders, galaxians, four joysticks. New £470, only £350. Tel: Shoreham-by-Sea 62296 after 6pm.

✱ NEC Spinwriter — 55 cps centronics parallel interface. Brand new but perspex front broken, awaiting replacement. £1250 for quick sale. Tel. Great Gransden (07677) 503 (Beds) after 6pm.

✱ Apple accessories — the following hardly used items are available for sale — DB Master £100, Videx card £140, Digitalker card £70, Locksmith £35 please ring Harlow (06284) 73776 or 73074.

✱ PET 32k — Model 3032 complete with commodore cassette deck and manual £350 ono. Phone Glenrothes 771092.

✱ 8k PET — New ROM 3008 expanded to 32k cassette deck, s/ware, manuals and cover. All for £425 or best offer. Phone Imerio 01-452 4555.

✱ Video Genie — EG 3003 48k expansion interface TEAC disk drive Newdos TRSDOS, Scripsit (lower case), profile DBMS quality games with sound. Eleven month guarantee £660 printer optional, telephone Hatfield (07072) 65466.

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✱ Tandy quick printer — £100: Tandy quick printer II £75: Aculab Floppy tape drive £125: Tel: Leicester 700619.

✱ MZ-80K Sharp — 48k 15 months guarantee left BASIC chess space invaders with extras. Exc. cond. £325 ono. Wakefield 373255 or 368239.

✱ Seikosha GP80A printer — and RS232 Interface GP-80010 as new. Hardly used. £200 separated £175 and £40. manuals included. Conta Contact John, 45 Callan Grove, South Ockendon, Essex. 0375 5122 Ext. 26, daytime.

✱ Texas TI-59 and printer with pakettes. Excellent condition. Numerous magnetic cards. Skid at £150 o.n.o. Telephone London (01) 850 6737 after 7.30 p.m. (Douglas Vere — Dresser).

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✶Apple II — plus single disk manuals, programs including database £925. Also Sharp MZ80k 120 programs. Documentation. Dustcover £325 Tel. Stratford upon Avon 298187 (Weekends).

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✶PET 3032 — 3040 disks, 3022 tractor printer, cables, manuals, soundbox, little used exc cond. recently serviced £300 of s/ware inc. Petchess Arcades, Adventures £300. Databse. Sale due to upgrade £1800 Cuffley 3507.

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✶Exchange my SLR camera — Topcon TTL metering, full auto shutter priority and manual, plus matching 135mm telephoto, for your ZX81 plus 16k RAM. Tel: 0532 666487 after 7 or w/ends.

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✶Commodore VIC20 — with C2N cassette unit only 3 months old, complete with lots of progs. £185 for quick sale. Tel: 01-800 6318 after 6 or 01-357 4453 daytime.

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ZX Sprectrum — 48k RAM. Only few weeks old. (BBC Micro forces sale) £165. Also ZXprinter, little used £45. Will split. Tel: Southend (0702) 75442 after 6.

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✶Video Genie — 48k LII, extra keys, sound, joysticks, manuals, books, magazines, green VDU, Level meter. over £400 s/ware, adventures, toolkits, Arcade, Edtasm+, compiler, Pascal. £600 ono. Tel Faversham 533851 eve.

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✶Video Genie EG 3003 32K RAM. Sound, extra keys, Joystick, leads, manuals, £500+ software: Adventures, assembler, Big 5, games, utilities. £100+ books. £350. Morling, The Mount, Hatfield Heath, Essex 0279 730284.

✶UK101 32K cased, Cegmon newmon 32 line 1-2 MHz, 300-600, Baud. Sound, new basic 1, 2, 4, 5, toolkit, parallel ports. Lots of software and useful documentation. £240. Asher, Tel: Long Eaton (Nottingham) 06076-66593.

✶TRS-80 L II, 48K, UDU, cassette, manual, high res worth £200, software worth £150 including W/P assem, debug, etc. Total worth over £1300 for £800 ono. Tel: 01-542 4624.

✶Video Genie EG3003, 16K, sound, built-in cassette recorder, manuals, loads of software: games, adventures, utilities, music. £280 ono. Tel: Burntwood (054 36) 3729.

✶Casio FX-602P Alphanumeric programmable calculator 512 steps, 88 memories. Only 3 months old. Microline 80 printer and tractorfeed. Superb condition. Any offers considered. Phone Jeff 01-458 3025 after 7 p.m.

✶Nascom 2 cased 64K CP/M DCS-DOS 2 dual disks (160K) Zeap, Nasdis, debug, Xtal. Basic with disk commands ono. Tel: Mike Turner Stoke-on-Trent (0782) 322948 daytime 324639 evenings.

✶PET 3008 large keyboard, external cassette recorder, dust-cover, manuals, books: "PET/CBM Personal Computer Guide", "6502 Assembly Language Programming", v.g.c. £250. Tel: John Gillham 01-856 3342 (Welling) Eves/Weekends.

✶Microtan 65. Mini Mother Board system Tanex, 8K RAM, Microsoft. Basic, graphics, upper lower case, querty keyboard, + numeric +extra, Hex pad, power supply. All cased £240 ono. Tel: 09277 68646.

✶PET 3008 New ROM, with Seikosha GP80 printer. All as new. Games, tapes and manual. Must sell £500 or offer. Tel: 01-567 3547 West London. eve. or weekends.

✶Acorn Atom 2K RAM + 82 ROM. Boxed, hardly used, £80. Tel: 051-625 6478.

✶VIC-20 + cassette + super Lander cartridge, Programmers Reference Book. As new. £170 ono. Tel: Leicester (0533) 872168.

✶PET 4032 with cassette. Basic 3.0 and 4.0. £400 ono. Command-o, Arrow, M.L. utilities, assembler/disassembler, and games, Eprom burner, ROM expansion board etc. All worth £400. Will accept offers. Tel: Maldon (0621) 828161 evenings.

✶MZ-8010 £75. Disk interface plus cable plus master disk and manual for MZ-80K system £75. Parallel interface card for MZ-810 £25. All with full documentation. S. Fielding. Tel: Rochdale 40877.

✶Apple II, 48K Europlus, NEC 8023 printer, two disc drives, Applewriter etc. Virtually new but outgrown it! £1200 complete. Phone 0981 540714 (Hereford) 10 till 5; Tuesday to Saturday. Will post.

✶Apple Software. Visicalc 3.2 £39; Magic window and basic mailer £49. All original disks with manuals in perfect condition. Phone Leeds (0532) 742427 9.30 to 5.30.

✶TRS-80 16K Level 2, green CRT, C1R-80 deck. Complete with over 100 items. Software including Arcade favourites. Also manuals and books. Sell £395 (worth £500) Tel: 01-600 1893 evenings only.

# TRANSACTION FILE

✱ 6303 CMOS Processor. Fast assembler runs on 32K PET. Disc £15 includes assemblers for 6502 and 6802/03 processors. S.a.e. details. M.J. Tyler, 2 Park View Drive, Cashes Green, Stroud, Glos. GL5 4NQ. 04536-77257.

✱ ZX Spectrum, printer, tape recorder, 2 Arcade games, several blank tapes with M/C progs. Why wait. Sinclairs, 10 Weeks when you can get one now. Only £180 inclusive ono. Phone Oli on 995 9485.

✱ Atari 800. Good condition, Joysticks, Recorder, manuals and many magazines. Games, software worth nearly £300. For good price Phone 997 8597 (01) evenings and weekends only. Urgent. Moving over to Canada soon.

✱ Sharp PC-1500 with CE-150. Colour printer/plotter + case. Mint condition. Hardly used.

✱ Sharp PC-1500 with CE-150 four colour printer/plotter + case. Mint condition. Hardly used. Lovely machine but no time to use it. £220 ono £320 new. Roger 01-448 2373 evenings/weekends.

✱ Acorn Atom one year old. 12K RAM 12K ROM V.I.A. All leads £50+ worth software inc. Invaders Galaxian Manual. Three books £200 Diss (0379) 3273 evenings.

✱ TRS-80 Level II 16K. Little used due to exams. All leads and manuals £100+ software including Invaders word processors, Chess etc. £295 ono. CTR-80A. Recorder £25. Phone Paul 01-950 9122 after 5 p.m.

✱ Sharp MZ-80K microcomputer 48K memory. Basic, green screen and dustcover. Integral VDU + cassette. Many programs, including adventures. One year guarantee. Sacrifice. Excellent cndition. Bargain, only £350! Telephone: Manchester (061) 223 4764 - evenings only.

✱ Video Genie EG3003 as new with leads, manuals, original box and guarantee includes bomber scramble, books covering 84 programmable games and graphics. Only £200. Tel: Marlow 72107.

✱ Nascom 2 48K Ram, Nas-sys 3, Graphics, sound, reliable 4800 Baud cassette, neat cased system (photograph available), Nasdis-Delong, Editor assembler, Basic toolkit, xtal, Basic, many games, full documentation £325. Phone 0935 850416.

✱ TRS-80 Level II 16K VDU, cassette recorder, software including Edtasm D-Bug Micro Train, Games books, manuals etc. £290. Tel. Peterborough (0733) 241975.

✱ TRS-80 L II 16K V.G.C. Numeric keypad. All leads and manuals, plus books, Pyramid and Microsoft Edtasm. Plus original packing. £275 ono. Tel: Portsmouth 661537.

✱ VIC 20 plus cassette unit and seven games. Only two months old. £150. Original packing. Write Mr. Garth, 25 Fellows Place, Millbridge, Plymouth.

✱ PET 16K New ROM 2001. Programmers Toolkit fitted in ROM. Large typewriter-style keyboard. External cassette deck. Exc. condition. £450. Includes games and manuals. Tel: 01-554 4470 after 6 p.m.

✱ Superboard, Cegmon, 24K, Basic's 4, 5 x, Premier screen enhancement (20 screen formats) Eprom-board, ABS case, PSU, Video & TV output, £75. Software value £475 sell £275. Tel: St. Albans 34566.

✱ Swap high quality camera and processingequipment for Apple II disk drives and printer plus other peripherals. Tel: Paul Reading (0734) 23931. Cash balancing agreeable.

✱ Atari 400/800 Software. Star raiders £20. Air strike £10; Ghost Hunter £12; Protector £13; Canyon Climber £13; Galactic Chase £11; Beta Fighter £8; Supercube £10. Please phone 01-851 5942 after 7 p.m.

✱ Nascom-2 64K RAM, boxed with power supply and lots of software (Pascal basic & games) £300. Also Nascom IMP Matrix printer with DOT graphics £200 ono. Tel: 051-487 9586.

✱ Sharp MZ-80K-48K 7 months old. Complete with basic manual and games which include Space Invaders and Othello £400. Telephone 0287-23827.

✱ Acorn Atom 12K RAM 12K ROM, F.P. PSU, All leads, manuals, Acorn built, software includes getting acquainted with atom, Invaders Flight simulator, Dogfight, ready to run £170. Tel: Garston 74755.

✱ Exidy Sorcerer 48K, S100 Expansion unit, 4 x 315K Micropolis drives, IDS printer, monitor, C Basic, M Basic, Word processing pack, CP/M, MDOS and some application packages. £1,600. Tel: 0420 84749.

✱ VIC-20 with cassette. Must sell very quick. Buying bike. £125. Ring Kevin on 01-291 0810 SE London.

✱ Texas T199/4A colour, sound, 16K RAM, unwanted prize, hence very cheap £100 ono. Also cassette £20. Would swop for NASCOM goodies. Phone Dave Sinclair - Copthorne (0342) 712220 weekends.

✱ UK101 16K. 12K Basic, Toolkit, Exmon in Eprom. 16/32 screen 1/2MHz. Both switchable. P.C.G., P.S.G., Assembler, HEX Keypad. Cegmon. New Basic 1,3,4. Many programs £185 ono. Phone evenings Mike Salter. 01-529 7858.

✱ Sharp MZ80K 48K Sharp printer and interface. Sharp assembler. One year old, one year warranty remaining. As new, little used. Genuine reason for sale. £550 ono. Tel: 031 663 7378.

✱ Sharp PC-1211, CE-122 printer, ARC Soft coding pads, 40 paper rolls, programs etc. £110 ono. Toshiba KT-1300 micro-recorder plus 4 cassettes, eraser: £52. Contact Stephen Coates, 105 Freedom Road, Sheffield.

✱ Acorn Atom 12K + 12K colour, PSU, printer interface. Software worth £80. All £195. KSR33 Teletype, excellent working condition £75. H. Mardia, Moorfield, Rombalds Lane, Ilkley, Yorks., LS29 8RT.

✱ Atari 800 16K 5 weeks old. Still under 2 year guarantee plus 410 program recorder, joysticks, star raiders cartridge and other games on cassette £460. Tel: Symington (Ayrshire) 830176.

✱ Atari 400 — 48K RAM Upgrade with basic cartridge, thermal printer, cassette, assembler/editor cartridge. Complete with all manuals, leads etc. Only few months old. £450 ono. Tel: 304-7529.

✱ ITT 2020, 48K, Applesoft ROMS, Visicalc 3.3, Applewriter JC, Pascal, Locksmith 4.1, £425, Seikosha GP80A, £160, Ikegami 9" monitor, £45, all vgc, Tel: 0272 603252 eve.

✱ Sharp MZ 80K — 48K with interfaced Seikosha GP 100A printer, including dust cover, 4 games cassettes, manuals, printer paper, as new, 8 months guarantee remaining. £600 boxed. Tel. Bristol (0272) 674570.

✱ Complete set of PCW's for sale from Vol I No 1 to date. Buyer collects. First reasonable offer secures. Tel: Esher 66442.

✱ Texas instruments PC 100B printer cradle for TI 58/59. All leads, instructions, boxed. Mint condition. £45. Mr. Knight Bedworth (0203) 313121.

✱ UK101 40K, cased, uprated PSU, Centronics printer interface. Boards and components for PE modules and 4800 BPS cassette interface. Cables, manuals and software. £300. Will deliver. Tel: Luton (0582) 454019.

✱ TRS 80 Model 1 Level 2 CPU, Expansion interface, 48K joystick cassette. All manuals and leads. Over 40 programs, mostly games still in original packing £450 ono. Contact C. Knipe, Dalton Hall, Conygham Road, Manchester.

✱ VIC 20 + cassette player + Arfon expansion board, + 8K RAM + 3K RAM + machine code monitor and documentation £320 ono. Tel 037 22 (Ashtead) 74282 evenings.

✱ ZX81 Sinc built plus 16K RAM (D.K. Tronics). All leads, PSU and manual. 3D Monster maze + adventure programme by Bug-Byte. 2 months old. £65. Tel: Mark - 061 (761) 7617.

✱ Acorn Atom, 12K RAM, 12K ROM, including floating point ROM, PSU, Leads, box, manual, 2 books, software including chess. £135 ono. Contact Tim Speight, Fernie Lodge, Husbands Bosworth, Leicestershire. Tel: 0858 880040.

✱ TRS 80 Level 2 expanded to 48K with cassette and TV leads. Also some software and manuals. Tel: 01-546 7711 Ext 208 9-5 weekdays. Dave Roberts, £325.

✱ Apple II + —, Ramex 128 card, £230. Ramex 16 card, £65, 6522 VIA card £40, or exchange for disk drive or colour card. Ring Beaconsfield 71591 after 6.30 pm, Ask for MAN.

✱ Customised PET 4032 features include repeat key, screen print, disc operating system. All ROM based. Reset, VMM sound and other extras. £595 inc 100 + programs. Tel: Chorley (02572) 73263 evenings/weekends.

✱ Wanted TRS 80 pocket computer with printer. Will give help with any Maths-type problems if price reasonable. Dr. R. Calver, 6 Albany Road, Bexhill, Sussex.

✱ Wanted disk drive(s) and controller, or expansion box for video genie. Will buy separately and will pay a reasonable price. Printer also required. Phone Great Yarmouth (0493) 62101 after 5 p.m.

✱ Wanted for TRS 80 Model I: Expansion interface and disk drives. Also back issues of '80 Micro-computing. Tel: David Jackoon, 01-304 3991.

✱ Wanted Software for Insurance Brokers to run on Act Sirius Computer. Please ring Raja 01-902 5211/2.

✱ Wanted VIC 20 + cassettes + "Programmers Reference Guide" for sale £170 cash. 01-802 3946 Peter Brunning.

✱ ZX80- 16K. Includes many issues of interface, manual, all leads, three books, space invaders and nightmare park cassettes. Ideal for beginner. All for £55. Tel. Stock 840602 Blackburn.

✱ BBC Model B as new. Various extras £400. Phone 0256-75717.

✱ Video Genie 48K RAM with expansion box, disk and printer interfaces, manuals, leads, m/c, programming book, printer cable, cassette recorder, sound unit. Phone Stevenage (0438) 60056. Selling price £450 ono.

✱ TRS 80 Level II 16K with UHF modulator for televison. Software includes editor/assembler and many games (including chess, adventures). Tel. Portsmouth (0705) 379411 X3302 (day) or Portsmouth 476335 (evening).

✱ Microtan 65 10K basic 8K RAM X BUG ASCII keyboard. HEX Keypad 19in rack Tansoft gazette tug. Newsletters ideal system electronics enthusiast. Tel 01 505 3223 eve. £150 ono.

✱ Acorn Atom — 13K RAM, 12K ROM, VIA, PSU, all leads, noise-free graphics switch and jogstick connector. Also £35 of software and Atom Magic Book £180 ono Phone (0738) 52339.

✱ Sharp MZ-80K 48K fitted with reset button. Manuals and software, including games and utilities. £350 carriage paid in Scotland. Bolt 11 High Street, Kirriemuir, Angus, DD8 4EY. 05752-2373.

✱ VIC 20 + cassette + 8K expansion + books etc. £200. Denis Yardley, 48 Park Road, Chandlers Ford, Hants. Phone 4532.

✱ Ithaca IA-1010 REV 2-0 S100 CPU board (2 $MH_3$). Tested and working. Full documentation available. £75 ono. Phone John Oxford (STD 0865) 58152.

✱ TRS-80 18K LII cassette recorder, manuals, editor/assembler, light usage, £200. R. Hodgson, 23 Atlantic Way, Lowedges, Sheffield S8 7FZ. Tel: 0742 44800 (office hours)

✱ VIC-20 and VIC cassette recorder and VIC revealed book. £195 ono. Telephone 01-764 6276 evenings. Hardly used.

✱ Atom 12 + 12K still under guarantee! Very good condition. All leads including 5V 3A PSU. Three books + lots of software including Galaxian Puckman Oefender Asteroids Adventures etc only £200 ovno Tel: (01) 254 0742.

✱ PET-32K, Basic 4, with cassette £450 8050 disc £700. Also cables, various ROMS, programs etc. for sale. Phone H. Melton, Milton Keynes (0908) 670630.

✱ Video Genie for sale. Good condition. Leads, manuals £300 worth of software. £300 the lot. Also 32K Nascom with colour graphics and printer £200 ono. Ring Chris on Tiverton 257 886.

✱ MZ-80K Extended basic, cassette and booklet. Keypad, single keystroke entry, auto, renumber, append, delete, find, show errors, auto-run save, etc. £12, or details s.a.e. 38 South Parade, Bramhall, Stockport.

✱ PET 32K new ROM inc cassette sound box. Green screen £150+ software inc invaders asteroids cosmiads + many more £450 ono. Telephone Finmere 7139 evenings.

✱ MZ-80K 48K 6 months old. Hardly used with green screen and basic plus. Accounts prog and dust cover. Perfect condition £300. Tel: 943 2410 Teddington.

✱ TRS 80 16K L II + cassette recorder + monitor. Lots of software including BIC 5. Edtasm Debue Pascal Ect £275 ono. Also Aculab floppy tape with twelve tapes + software £125 ono. Tel: Tony on Bristol 422373.

✱ MZ-80K 48K RAM with 10 months warranty, pascal, M/C + ststem package, knights forth, fortran, pascal + commander xtal/double/p + disc. Basics plus 100 + programs xtal + Sharp/B £450 ono. 8, Blackdown Avenue, Waterthorpe, Sheffield S19 6NG, S. Yorks.

✱ PET 2001 8K Integral cassette deck and VDU. Recently serviced. London area but initially Contact 0227 65948 anytime.

✱ Acorn Atom -14K RAM, 12K ROM, 6522 VIA, Bus connector and buffers, external PSU, manuals and software £150. Tel: (0634) 33718 (Medway) evenings.

✱ TRS 80 — LII 16K, numeric keypad, PSU, UHF modulator, leads, manuals, etc. Includes: editor/assembler, several books, software (eg. missile command, death maze, crowley manor, etc.) Only £300. Phone: Maidenhead 27854.

✱ PET 8K Old ROM. Green screen as new ROM PETs, Integral cassette. Complete with dust cover, manual, 14 games programs. £200. Telephone: South Benfleet (03745) 54633. After 5 p.m.

✱ Video Genie — 16K, Boxed with all leads and manuals, plus sound generator worth £35 plus £120 of high quality software. Total worth £480, selling for £245 ono. Tel: 01-340 5414.

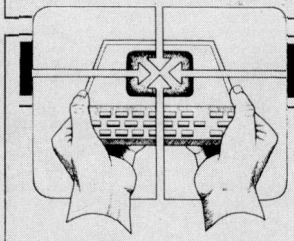
✱ TRS 80/Genie software edit/assembler D/Bug space invaders and Zchess. All machine code invaders. Very fast. Worth over £60, will sell £35 ono. Telephone Plymouth (0752) 707962.

✱ Video Genie 18 months old. Boxed complete with leads B/White portable TV monitor, manuals, software, joysticks, sound box. £240 ono. Quick sale required. Tel: Faygate 578 (029383) Std Code.

✱ Microline 80 Matrix printer witt diplomat parallel interface card and disk for printing righ-res pictures or graphs on Apple II or ITT, £180. Tel: 01-394 1678 evenings/weekends.

✱ Olivetti calculator/computer. Very extensive maths capabilities, printer, magnetic cards storage, 15 digit precision, expansion ports, manuals and accessories. £100 ono. H. Sauro, C/o Mrs. Walde, 9 Stile Road, Headington, Oxford.

✱ Video Genie 16K + sound, extra keys, manuals, leads. Over £150 of software including tool-kit and arcade games. Good condition. £250 ono. Tel: (0625) 828549 (Cheshire).



# CTUK! CONTACTS

*For further information on ComputerTown UK! see 'CTUK News' or Prestel page *800803 #*

Christopher Bates
Ashford Main Library
Church Road
Ashford Kent

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Ray Skinner
62 Central Avenue
Billingham
Cleveland TS23 1LN

Brian Taylor
Tonbridge Area Library
Avebury Avenue
Tonbridge
Kent

Paul Maddison
Gardenways
Chilworth Towers
Chilworth
Southampton SO1 7JH

Peter Jarvis
c/o Health Dept
Corporation of London
Guildhall
London EC2

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Bill Gibbings
3 Longholme Road
Retford
Notts DN22 6TU

Chris Cooper
110 Church Road
Hanwell
London W7

Lyn Antill
1 Defoe House
Barbican London EC2

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford BD3 8HG

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

BJ Candy
9 Oakwood Drive
Gloucester GL3 3JF

Roger Shears
18 Woodmill Lance
Bitterne Park
Southampton
SO2 4PY

Chris Woodford
31 Hopley Road
Anslow Burton-On-Trent
Staffordshire

Mike Perry, Steve Collas
or Dave Lee
The Library,
Ealing Road,
Wembley,
Middlesex HA0 4BR

# CTUK! CONTACTS

J M A Kilburn
(Headmaster)
Shawfield Norden
Community Middle School
Shawfield Lane
Norden
Rochdale
OL12 7QR

Robin Bradbeer
Polytechnic of North London
Holloway Road
London N7

Derrick Daines
18 Cuttings Avenue
Sutton in Ashfield
Notts

Patrick Colley
52 Queensway
Caversham Park Village
Reading
Berks RG4 0SJ

Philip Joy
130 Rush Green Road
Romford
Essex

Pete Shaw
15 St Vincent Road
Clacton-on-Sea
Essex C015 1NA

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

Peter J Kiff
52 Stone Road
Broadstairs
Kent CT10 1DZ

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne
Tyne & Wear

David Sharp
5 Bridgenhall Road
Enfield
Middx

Rex Shipton
17 Woodlands Avenue
Eastcote
Middx

Susan Kelly
Head of Reference
Services
PO Box 4
Civic Centre
Harrow
Middx

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

Alan Sutcliffe
4 Binfield Road
Wokingham
Berks RG11 1SL

Peter Earthy
46 High Street
Church Stretton
Shropshire
SY6 6BX

Tony Cartmell
54 Foregate Street
Worcester WR1 1DX

R L Saunders
14 St Nicholas Mount
Hemel Hempstead
Herts

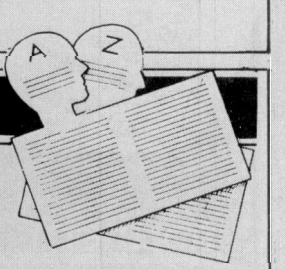
Brigitte Gordon
18 Purbright Crescent
New Addington
Croydon CR0 ORT

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Pam Pollicott
South Ruislip Library
Victoria Road
South Ruislip
Middx

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear
NE8 1TL

# USER GROUPS INDEX




*e are alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition*

NATIONAL
Irish Amateur Computer Club, recently formed, wishing to hear from anyone interested in computing in Dublin and other parts of Ireland. Contact: Martin Stapleton, 48 Seacourt, Clontarff, Dublin 3. Tel 331304, or send SAE to Brendan Hailgan, 22 Gortmore Ave, Finglas South, Dublin 11.

Sharp Users' mag — for all Sharp computers. Anyone interested? Subscription will be between £4-£6. Contact JP Griffiths, 104 Waterloo Road, Southport, Merseyside PR93AY. This mag will be bi-monthly and is at present only under consideration.

REGIONAL
Dorset — Topic (Tandy Owners Programming & Information Club) for Dorset. Contact: David Washfod, 1, Alexandra Road, Bournemouth, BH6 5JA. Tel: 0202 671122 (day) 0202 423964 (eve).

TOWNS
Bangor & District Microcomputer Users' Group. Meetings fortnightly in Bangor Community Centre, High Street, Bangor. For more details contact: Dilwyn Jones, Fodol Farm, Hafod Lane, Bangor.

Bridgend area. Computer club meets second Saturday monthly at the Pencoed library near Bridgend. Membership £5 pa — £3.50 for OAPs and students. Times are: 3pm-5pm. Contact: Philip Williams on 0656 860307 (after 6pm).

Cambridge Area: MZ-80K User Group. Membership free and if a blank cassette is sent in, programs from the library can be used. Newsletter also. Contact: Piers Hendrie, 19 Madingley Road, Cambridge CB3 OEG — send SAE for details.

Cambridge — Chesterton Computer Club. Meetings weekly in Chesterton Adult Centre on Fridays at 7.30. Contact: Gillian Turner, 56 Union Lane, Cambridge CB4 1QB. Tel: Cambridge 31201.

Cheltenham Amateur Computer Club. Meets monthly on the 3rd Tuesday of each month (except December). Meetings start 7.30pm at the Prestbury Scout HQ. For further details contact Mike Highes, Cheltenham 75213.

Chiltern Microcomputer Club (South Bucks). Meets first Wednesdays monthly. Contact: Wendy Tibbitts, Chalfont-St-Giles 4906.

Keighley & District Computer Club. Meetings approx every 3 weeks at Keighley Technical College. Subscription £6 per 6 months. Contact Hon Sec Bill Hensman. Tel: Keighley 61681.

LAMS (Loughborough Area Micro Society) meetings held on the 2nd Wednesday monthly at 7.30pm in room N202 of the Haslegrave Building in Loughborough University. Contact: Bob Harding, Human Sciences Dept, LVT. Tel: Loughborough 263171.

Nottingham Microcomputer Club. Please note new secretary: Dr ED Harvey, 68 Roseleigh Avenue, Mapperley, Nottingham. Tel: 0602 608491 (eve) or 0602 48248 ext 2322 (day).

# NETWORK NEWS

*These are all the European networks of which we're aware. Most are free — but phone them for details.*

**Forum-80 Hull. . .** (Forum-80 H,Q) Tel: 0482 859169, System operator Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10,00pm Sat/Sun 1.00pm to 10.00pm.

**Forum-80 London. . .** Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

**Forum-80 Milton. . .** (TRS-80 Users Group 80-Net) Tel: 0908 566660. System Operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00 pm.

**Forum-80 Holland. . .** Operator: Nico Karssemeyer, tel 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

**CBBS London. . . Operator:** Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

**Mailbox-80 Liverpool. . .** 051-220 9733, System Operator: Peter Tootill, Electronic mail, downloading TRS-80 information.

ACC. . . members bulletin board, Peter Whittle (0908 44262)

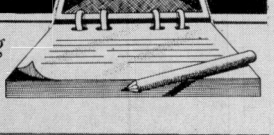
ABC-80. . . Stockholm, Sweden) Tel: 010 468 190522.

**University Research Computer. . .** Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

**Elfa. . .** Sweden 010 468 7300 706

**Tree Tradet. . .** Sweden 010-468 190522.

# DIARY DATA



*Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.*

| | | |
|---|---|---|
| Bristol | (Holiday Inn) Business Equip & Services Exbn. Contact: Douglas Temple Design Group, 0202 20533 | 24-25 Nov |
| Manchester | (Belle Vue Hotel) Northern Computer Fair. Contact: IPC Exbns Ltd, 01-643 8040 | 25-27 Nov |
| Dubai | Gulf Computer Exbn. Contact: Trade Centre Management Co, 01-930 3881 | 13-16 Dec |
| Swansea | (Leisure Centre) Microshaw. Contact: Centre for Trade & Industry, 0792 50821 | 13-15 Jan |
| USA | (Atlanta, Georgia) Southcon Electronics Show. Contact: ECL (Exhibition Agencies) Ltd, 01-486 1951 | 18-20 Jan |
| Birmingham | (NEC) Which Computer Show. Contact: Clapp & Poliak Europe Ltd, 01-747 3131 | 18-21 Jan |

MICROMART

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# PROGRAMS

*PCW is interested in programs written in Basic, Pascal, Forth, Logo and Comal — all of which being languages we've covered in previous issues. Please supply your programs on disk or cassette with all necessary documentation (so we've got a good idea what it's about and how much memory it uses) and, if you can, a clear listing on plain white paper.*

*As all programs in PCW are checked either by a referee or by one of the editorial staff, it can take some time for a program to actually appear. If you don't hear from us within two months or so, it usually means your contribution is in the referee pipeline. It's essential to ensure that your program is fully debugged before you send it in — get a friend to try it out first — and all programs we publish are paid for at a regular rate. Send contributions to: Maggie Burton, PCW Programs, 62 Oxford Street, London W1A 2HG — and please enclose an SAE if you want material returned.*

## Getting competitive

This should keep you on your toes: to introduce a bit of healthy competition into 'Programs' a prize of £25 will be awarded to the writer of the 'Program of the Month'. This'll be on top of what would normally be paid for a program.

Any contribution sent in for 'Programs' will be eligible, including those I've had in the pipeline up to now. It'll be judged on several criteria — annotation, ideas and their implementation, use of a machine's facilities, user friendliness, originality and innovation.

From the January issue onwards the masterpieces chosen will be specially marked and I'll give an explanation as to why each program is chosen. Length won't matter — unless your program is actually too long to fit in — and all programming languages normally accepted are eligible. So if you've lost interest in that program you've been bashing away at for the past few weeks/months/years, Program of the Month should prove incentive enough to get it finished.

Lastly, I'll here remind readers that no correspondence whatever will be entered into regarding *PCW's* judgement on programs.

## PET Firebird

by Michael Fok

There must be thousands of sticky-fingered, bug-eyed space game addicts who'll find this game keeps them happy over Christmas. It combines many of the dubious qualities of Asteroids, Space Invaders and Phoenix in a series of four little sub-games and it's even got a story behind it. Unfortunately the text in this listing could be improved by some discreet editing, but it's readable and easily absorbed.

The rather comprehensive instructions are entirely optional, as they're a separate program occupying almost 5k. If you don't feel like typing them in you can read them from the listing. The game itself takes up just over 7k. Both programs use machine code which occupies the second cassette buffer and when the instructions have run the program exits, so to avoid keying-in twice (as you have to type NEW between instructions and game), save the instructions before you run them. Once you've typed NEW, run the game. Pressing key 'N' after running will prevent the 'STOP' key from being disabled — on a 'new ROM' PET.

In the first three stages of the game you can cheat by pressing 'C' (if you're the cheating type), but this won't actually make things much easier as you can't cheat on the fourth stage. Firebird will run on any PET. It was tested using Basic4 and Basic2.

**Game**

```
READY.

 1 REM     ************************
 2 REM     ***FIREBIRD VERSION 1.1***
 3 REM     ********M.FOK -82*********
 4 REM     ************************
 5 REM
```

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# PROGRAMS

```
 6 REM
 7 REM
 8 FORI=1TO100:GETA$:IFA$="N" THEN30
 9 NEXTI
10 IF PEEK(50003)=1 THEN POKE144,49
15 IF PEEK(50003)=160 THEN POKE 144,88
20 IF PEEK(50003)=0 THEN POKE 59458,255
30 ER=515-(364*SGN(PEEK(50003)))
100 REM***FIREBIRD ATTACK***
110 DEF FNA(AX)=32768+AX+AY*40
120 AX=20:AY=21:EX=2:EY=1:F1=0:F2=0:F3=0:DI=1
130 Y$="■■■
```

# MICROMART


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# PROGRAMS

```
2610 IF EX=AX THEN S=S+30:GOTO2900
2620 PRINT"■"RIGHT$(Y$,AX);"
2630 GOTO2200
2900 FORI=1TO50:POKE E1,60:POKE E1,170:POKE E1,62:POKE E1,32:NEXTI
2910 GOSUB7000:GOTO4000
4000 REM***PLANET ATTACK***
4010 GOSUB8300:GOSUB8000
4100 AP=33707:MA=33727:MI=33688:FO=40:MP=32768:S1=160:E1=33757:DI=-1
4110 FORN=33728 TO 33767:POKE N,99:NEXTN
4120 F1=0:F2=0:F3=0
4200 POKE AP,32
4210 A=PEEK(ER):IF A=42 THEN AP=AP+(AP>MI)
4220 IF A=41 THEN AP=AP-(AP<MA)
4225 IF F1=1 THEN  4250
4230 IF A=48 THEN F1=1:LP=AP-FO
4250 POKE AP,1
4260 SYS826
4300 IF F2=0AND ABS(33709-AP)<3 THEN F2=1:EL=33229+INT(RND(1)*5)-2:S1=PEEK(EL)
4310 IF F2=1 THEN GOSUB 4700
4320 IF INT(RND(1)*3)=0 THEN 4440
4400 POKE E1,99:E1=E1+DI:IF E1<33729 THEN E1=33729:DI=1
4410 IF E1>33766 THEN E1=33766:DI=-1
4420 IF INT(RND(1)*10)=0 THEN DI=INT(RND(1)*2):IF DI=0 THEN DI=-1
4430 POKE E1,22
4440 IF INT(RND(1)*6)=0 THEN 4900
4450 IF F1=0 THEN 4200
4500 POKE LP,32:FORI=1TO3
4510 LP=LP-40:IF PEEK(LP)<>32 THEN F1=0:GOTO4600
4515 IF LP<MP THEN F1=0:GOTO4200
4520 NEXTI:POKELP,34:GOTO4200
4600 A=PEEK(LP):IF A>128 THEN POKE LP,120:GOTO4200
4610 IF A<>99 THEN POKELP,32:GOTO4200
4620 S=S+30:A=LP:S1=80:GOSUB9100:A=LP:S1=32:GOSUB9100:RESTORE:GOTO100
4700 POKE EL,S1
4710 EL=EL+40:IF EL>33687 THEN 4800
4720 S1=PEEK(EL):POKE EL,81:RETURN
4800 FORI=-2 TO 2:POKE EL+I,86:NEXTI
4810 IF ABS(EL-AP)<3 THEN 9050
4820 FORI=-2 TO 2:POKE EL+I,32:NEXTI
4830 F2=0:RETURN
4900 POKE E1-40,30
4910 IF AP=E1-40 THEN 9050
4920 POKE E1-40,32
4940 GOTO4450
7000 REM***DRAW RING***
7010 PRINT"■";:FORI=1TO25:PRINT"■**********************************■"
7020 NEXTI:PRINT"■";:FORI=1TO25:PRINT"
7030 NEXTI:RETURN
7500 FORI=1 TO 50:POKE AP,60:POKE AP,170:POKE AP,62:POKE AP,32:NEXTI
7520 P=P+1:IF P<>3 THEN RESTORE:GOTO100
7560 PRINT"■■■■"
7570 PRINT"■■■■ ■■■  ■■■■  ■■■■ ■■■  ■■■ ■■■  ■■■ "
7580 PRINT"■    ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■"
7590 PRINT"■    ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■"
7600 PRINT"■■■  ■  ■■■■ ■■■  ■■■  ■  ■■■  ■  ■"
7610 PRINT"■    ■  ■■  ■  ■  ■  ■  ■■  ■  ■  ■"
7620 PRINT"■    ■  ■ ■  ■  ■  ■  ■  ■ ■  ■  ■  ■"
7630 PRINT"■    ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■"
7640 PRINT"■    ■■■  ■  ■ ■■■■ ■■■  ■■■ ■  ■ ■■■ "
7660 A$="        VERSION 1.1 BY M.FOK-82"
7670 FORI=1TOLEN(A$):PRINT"■■■■■■■■■■■■■■";:PRINTRIGHT$(A$,I):NEXTI
7680 RESTORE:GOSUB8350:RESTORE
7690 FORI=1 TO 25:SYS826:FORN=1TO20:NEXTN,I
7700 PRINT"■■■■■■■■■■■■      PRESS 'G' FOR A NEW GAME"
7710 PRINT"          YOUR SCORE IS";S
7715 GETA$:IF A$="-" THEN END
7716 IF A$<>"G" THEN 7715
7720 RUN
8000 REM *** DRAW PLANET ***
8100 PRINT"■■■■■
8110 PRINT"
8120 PRINT"
8130 PRINT"
8140 PRINT"
8150 PRINT"
8160 PRINT"
8180 PRINT"
8190 PRINT"
8200 PRINT"
8210 PRINT"
8220 PRINT"
8230 RETURN
8300 REM *** ROTATE RING ***
8310 FORN=826 TO 843:READ A:POKE N,A:NEXTN
8320 RETURN
8350 REM ***BOMB M.C.***
8360 FORI=826 TO 929
8370 READ A:POKE I,A:NEXTI:RETURN
9000 REM ***U.EXPLOSION***
9010 IF S1=32 THEN S1=32:S2=32:S3=32:S4=32:GOTO9030
9020 S1=77:S2=66:S3=78:S4=64
9030 FORI=1TO10:POKE A-41*I,S1:POKE A-40*I,S2:POKE A-39*I,S3
9040 POKE A-I,S4:POKE A+I,S4:FORN=1TO50:NEXTN,I:RETURN
```


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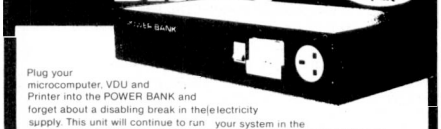
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# PROGRAMS

```
9050 A=AP:S1=80:GOSUB9000:A=AP:S1=32:GOSUB9000:GOTO7520
9100 REM ***F.EXPLOSION***
9110 IF S1=32 THEN S1=32:S2=32:S3=32:S4=32:GOTO9130
9120 S1=77:S2=66:S3=78:S4=64
9130 FORI=1TO10:POKE A-41*I,S1:POKE A-40*I,S2:POKE A-39*I,S3:POKE A+I,S4
9140 POKE A+41*I,S1:POKE A+40*I,S2:POKE A+39*I,S3:POKE A-I,S4
9150 FORN=1TO30:NEXTN,I:RETURN
9800 REM*** BOMD DATA ***
9805 DATA 162,240,189,255,127,201,81,240,42,202,208,246,162,240,189,239
9810 DATA 128,201,81,240,43,202,208,246,162,240,189,223,129,201,81,240,44
9820 DATA 202,208,246,162,240,189,207,130,201,81,240,45,202,208,246,96,0,0,169
9830 DATA 32,157,255,127,169,81,157,39,128,76,67,3,169,32,157,239,128,169,81
9840 DATA 157,23,129,76,79,3,169,32,157,223,129,169,81,157,7,130,76,91,3,169
9850 DATA 32,157,207,130,169,81,157,247,130,76,103,3,255
9860 REM*** SCRAMBLE DATA ***
9870 DATA 172,0,3,136,140,0,3,208,56,160,2,140,0,3,162,39,172,111,131,140,72
9880 DATA 131,189,71,131,157,72,131,202,208,247,162,39,172,71,131,140,32,131
9890 DATA 189,31,131,157,32,131,202,208,247,162,39,172,31,131,140,248,130,189
9900 DATA 247,130,157,248,130,202,208,247,173,247,130,141,0,128,169,32,141,247
9910 DATA 130,162,255,189,255,127,201,87,240,31,202,208,246,162,255,189,254
9920 DATA 128,201,87,240,32,202,208,246,162,249,189,253,129,201,87,240,33,202
9930 DATA 208,246,96,0,0,0,169,32,157,255,127,169,87,157,0,128,76,143,3,169,32
9940 DATA 157,254,128,169,87,157,255,128,76,155,3,169,32,157,253,129,169,87,157
9950 DATA 254,129,76,167,3
11000 DATA162,20,172,174,129,189,154,129,157,155,129,202,208,247,140,155,129,96
```

# Instructions

```
READY.

 1 REM      ************************
 2 REM      *FIREBIRD I INSTRUCTIONS**
 3 REM      ****WORDS BY S.J.MORRIS***
 4 REM      ***PROGRAM BY M.FOK 1982**
 5 REM      ************************
 6 REM
 7 REM
 8 REM
 9 REM
 10 Y$="■■■■■■■■■■■■■■■■■■■■■■■■■■■■"
 100 FORI=826 TO 931:READA:POKEI,A:NEXTI
 110 GOTO9500
 200 READA$:IF A$="*"THENPRINT:PRINT:PRINT"■PRESS ANY KEY■":Y=1:GOSUB8000:PRINT"
■":READA$
 210 IF A$="@" THEN 500
 220 FORI=1TO39:PRINT"■";RIGHT$(Y$,Y);RIGHT$(A$,I):NEXTI:Y=Y+1
 230 GOTO200
 500 PRINT"■":END
 510 GETA$:IFA$<"1" OR A$>"8" THEN 510
 520 A=VAL(A$):LOAD"FIREBIRD I",A
 4000 DATA 162, 39, 189, 199, 128, 157, 200, 128, 202, 208, 247, 162, 39
 4010 DATA 189, 23, 129, 157, 24, 129, 202, 208, 247, 162, 39, 189, 103
 4020 DATA 129, 157, 184, 129, 202, 208, 247, 162, 39, 189, 183, 129, 157, 184
 4030 DATA 129, 202, 208, 247, 162, 0, 189, 241, 128, 157, 240, 128, 232, 224
 4040 DATA 38, 208, 245, 162, 0, 189, 65, 129, 157, 64, 129, 232, 224, 38
 4050 DATA 208, 245, 162, 0, 189, 145, 129, 157, 144, 129, 232, 224, 38, 208
 4060 DATA 245, 162, 0, 189, 225, 129, 157, 224, 129, 232, 224, 38, 208, 245
 4070 DATA 96, 0, 0, 0, 255, 0, 255, 0, 255, 0
 5000 DATA"■","                INTRODUCTION"," "," "
 5005 DATA "  BACK IN THE 20TH MAN REALISED THE"
 5010 DATA"EARTH IS ON ITS LAST LEG-NO RESOURCES"
 5020 DATA"OR SPACES.THEN BEGAN A PHENOMENAR"
 5030 DATA"SPACE RESEARCH PROGAM BEGAN IN A LAST"
 5040 DATA"DITCH ATTEMPT TO SURVIVED.IT PROVED"
 5050 DATA"FRUITFUL,YIELDING THE EARTH-LIKE "
 5060 DATA"PLANET ZOG IN THE ORWELLIAN MAJOR "
 5070 DATA"GALAXY.HOWEVER,IT HAS ONE DRAWBACK-"
 5080 DATA"THE NEARBY PLANET PLANET OF ARGON."
 5090 DATA"THE ARGONITES RESENT THE HUMAN RACE"
 5100 DATA"FOR INTRUDING AND PATROL YOUR PLANET."
 5110 DATA"AGRONITES HAVE COMMITTED HORRIBLE "
 5120 DATA"ATROCITIES ON YOUR PEOPLE.NOW THEIR"
 5130 DATA"LEADER ZARGON HAS BUILT A STARBASE"
 5140 DATA"FROM WHICH TO ATTACK YOUR PEOPLE.",*
 5150 DATA"MANY OF OUR BEST MEN HAVE ALREADY"
 5160 DATA"BEEN EXTERMINATED IN AN EFFORT TO"
 5170 DATA"ATTACK HIS BASE.ONLY 50 CENTRONS"
 5180 DATA"AGO A WHOLE FLEET WAS DESTROYED.YOU"
 5190 DATA"ARE OUR LAST RESORT,YOU MUST FIRST "
 5200 DATA"SUCEED TO LIFT OFF IN AN UNPATROLLED"
 5210 DATA"AREA AFTER YOU DESTROYED ALL FIREBIRDS"
 5220 DATA"IN SIGHT.AFTER TAKING OFF YOU MIGHT"
 5230 DATA"GET CAUGHT IN A METEOR STORM WHICH"
 5240 DATA"OFTEN OCCURS IN ZOG REGION.ANYTIME"
 5250 DATA"DURING THE JOURNEY YOU COULD WELL"
 5260 DATA"RUN INTO AN ARGONITE FIGHTER WHICH"
 5270 DATA"YOU HAVE TO DESTROY IT BEFORE IT "
 5280 DATA"DESTROY YOU.FINALLY THEIR STARBASE"
 5290 DATA"IS WELL DEFENDED.GOOD LUCK"
 5295 DATA" ","                          MAJOR GENERAL"
 5300 DATA"                            S.J MORRIS",*
 5310 DATA"MISSION-1"
```


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# PROGRAMS

```
5320 DATA"YOUR AIM IS TO DESTROY ANY ATTACKING"
5330 DATA"FIREBIRD(S).BUT WATCH OUT !FIRBIRDS"
5340 DATA"ARE DEADLY SINCE YOU CAN ONLY DESTROY"
5350 DATA"IT BY HITTING ITS SOFT STOMACH"
5360 DATA"ON THE CONTROL BOARD YOU:"," "
5370 DATA"PRESS '4' TO MOVE LEFT"
5380 DATA"PRESS '6' TO MOVE RIGHT"
5390 DATA"PRESS 'A' TO FIRE",*
5400 DATA"MISSION-2"
5410 DATA"YOU MUST AVOID THE ASTEROIDS WHICH "
5420 DATA"APPEAR FROM THE TOP OF THE SCREEN "
5430 DATA"AND MOVE LOWER AND LOWER FOR A SET"
5440 DATA"TIME(TIME IS DISPLAY UNDER THE LAND-"
5450 DATA"SCAPE AFTER THE FIRST ASTEROID REACH"
5460 DATA"THE BOTTOM OF THE SCREEN)."
5470 DATA"ON THE CONYROL BOARD YOU:"," "
5480 DATA"PRESS '0' TO MOVE UP"
5490 DATA"PRESS 'A' TO MOVE DOWN",*
5500 DATA"MISSION-3"
5510 DATA"YOU MET AN ARGON FIGHTER WHICH WILL"
5520 DATA"ATTEMPT TO ZAP YOU SO YOU MUST ZAP"
5530 DATA"IT BEFORE IT SUCEED.HOWEVER YOU MAY"
5540 DATA"ONLY FIRE WHEN YOUR ENERGY(LEFT ONE"
5350 DATA"IT BY HITTING ITS SOFT STOMACH"
5360 DATA"ON THE CONTROL BOARD YOU:"," "
5370 DATA"PRESS '4' TO MOVE LEFT"
5380 DATA"PRESS '6' TO MOVE RIGHT"
5390 DATA"PRESS 'A' TO FIRE",*
5400 DATA"MISSION-2"
5410 DATA"YOU MUST AVOID THE ASTEROIDS WHICH "
5420 DATA"APPEAR FROM THE TOP OF THE SCREEN "
5430 DATA"AND MOVE LOWER AND LOWER FOR A SET"
5440 DATA"TIME(TIME IS DISPLAY UNDER THE LAND-"
5450 DATA"SCAPE AFTER THE FIRST ASTEROID REACH"
5460 DATA"THE BOTTOM OF THE SCREEN)."
5470 DATA"ON THE CONYROL BOARD YOU:"," "
5480 DATA"PRESS '0' TO MOVE UP"
5490 DATA"PRESS 'A' TO MOVE DOWN",*
5500 DATA"MISSION-3"
5510 DATA"YOU MET AN ARGON FIGHTER WHICH WILL"
5520 DATA"ATTEMPT TO ZAP YOU SO YOU MUST ZAP"
5530 DATA"IT BEFORE IT SUCEED.HOWEVER YOU MAY"
5540 DATA"ONLY FIRE WHEN YOUR ENERGY(LEFT ONE"
5550 DATA"IS FOR AGRONITE FIGHTER WHILE THE"
5560 DATA"RIGHT ONE IS YOURS)IS TEN."
5570 DATA"ON THE CONTROL BOARD YOU:"," "
5580 DATA"PRESS '0' TO MOVE UP"
5590 DATA"PRESS 'A' TO MOVE DOWN"
5600 DATA"PRESS '4' TO FIRE",*
5610 DATA"MISSION-4"
5620 DATA"YOU MUST SHOOT THROUGH THE WELL "
5630 DATA"DEFENDED STARBASE AND KILL THEIR"
5640 DATA"LEADER ZARGON.(SINCE NO-ONE HAS GOT"
5650 DATA"THAT FAR YET,THEREFORE THE INFORMATION"
5660 DATA"MIGHT BE WRONG"
5670 DATA"ON THE CONTROL BOARD YOU:"," "
5680 DATA"PRESS '4' TO MOVE LEFT"
5690 DATA"PRESS '6' TO MOVE RIGHT"
5700 DATA"PRESS 'A' TO FIRE"
5710 DATA" "," ","SPECIAL COMMAND:"
5720 DATA"PRESS 'C' AT ANY MISSION(EXCEPT LAST"
5730 DATA") FOR CHEAT.",*
5740 DATA"                SYMBOLS"
5750 DATA"'A'.....FIREBIRD"
5760 DATA" O.....ASTEROID"
5770 DATA" >.....ARGONITE FIGHTER"
5780 DATA"\___/   "
5790 DATA"(oxo)   "
5800 DATA" \W/ .....ZARGON"
5810 DATA"  ¯     ",*,@
8000 GETB$:IF B$="" THEN 8000
8010 RETURN
9500 PRINT"■■■■"
9510 A$(1)=" ■■■■ ■■■  ■■■  ■■■■ ■■■  ■■■ ■■■  ■■■  "
9520 A$(2)=" ■    ■  ■ ■ ■  ■  ■ ■ ■  ■  ■ ■ ■  ■ "
9530 A$(3)=" ■    ■  ■ ■ ■  ■  ■ ■ ■  ■  ■ ■ ■  ■ "
9540 A$(4)=" ■■■  ■  ■■■ ■■■  ■■■  ■  ■■■  ■  ■ "
9550 A$(5)=" ■    ■  ■■  ■ ■  ■ ■  ■  ■ ■  ■  ■ "
9560 A$(6)=" ■    ■  ■ ■ ■ ■  ■ ■  ■  ■ ■ ■  ■ "
9570 A$(7)=" ■    ■  ■  ■ ■  ■ ■  ■  ■ ■  ■  ■ "
9580 A$(8)=" ■    ■■■  ■  ■ ■■■■ ■■■  ■■■ ■  ■ ■■■  "
9590 A$=" INSTRUCTION FOR FIREBIRD I BY M.FOK-82"
9600 FORA=1TO37
9605 PRINT"■■■■■";
9610 FORB=1TO7STEP2
9620 PRINT"■";MID$(A$(B),(38-A),1)
9630 PRINT"■■■";MID$(A$(B+1),A,1);"□"
9640 NEXTB
9650 SYS8826
9660 NEXTA
9676 PRINT"■■■■■";:FORI=1TO8:PRINT"■";LEFT$(A$(I),39);:NEXTI
9680 FORI=1TO39:PRINT"■■■■■■■■■■■■■■";RIGHT$(A$,I):NEXTI
9690 FORI=1TO500:NEXTI:GOTO200
```

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# PROGRAMS

## Teepee Textpro

by Mike O'Regan

This is the only program anyone's ever sent me for the TI99/4A. It's a word processor which works with the TI Thermal Printer, but if anyone wants to reconfigure it for use with a different printer the relevant lines to change are 1720, 1740 and 2630. Lines 1980, 2190, 2240 and 2630 should all have the '28' changed to suit the line length of any other printer. All the instructions you'll need to process your words of wisdom are contained within the program as a menu.

As listed it will print out 28 columns to match the screen. Control characters for upper case (∧) and indent (>) are not included in the characters per line count.

One of its neat features is that it uses the TI99/4A's character redefinition facilities and the Thermal Printer's ability to mimic the chosen character font. The characters used here are customised, offering lower case with true descenders. These can be obtained directly from the keyboard.

TeepeeTextpro does posess some minor limitations — which were deliberate in the interests of saving RAM. It doesn't offer automatic line wrap-around, block deletion or insertion or line length safeguards on edited lines. However, it does SAVE and LOAD your text to and from cassette at the press of a key.

For users of the TI99/4A this program will be useful as a rough word processor, although I couldn't see it being used for business letters and suchlike unless a more conventional printer were used.

```
100 REM TEEPEETEXPRO
110 REM BY MIKE O'REGAN
120 REM UPDATED 2/09/82
130 REM
140 REM CUSTOM CHAR SET
150 DATA 00101010001
160 DATA 002828
170 DATA 00287C287C28
180 DATA 00382070207C
190 DATA 006468102C4C
200 DATA 00205020545824
210 DATA 00101
220 DATA 000810101008
230 DATA 00201010102
240 DATA 002828
250 DATA 0010107C101
260 DATA 0000000060204
270 DATA 00000007C
280 DATA 00000000606
290 DATA 0000000060204
300 DATA 00384C546438
310 DATA 001030101038
320 DATA 00384408107C
330 DATA 003844184438
340 DATA 000818287C08
350 DATA 007C403C047C
360 DATA 001020784438
370 DATA 007C0810202
380 DATA 003844384438
390 DATA 00384438C081
400 DATA 00303000303
410 DATA 0030300030302
420 DATA 000204080402
430 DATA 00007C007C
440 DATA 00201008102
450 DATA 00384418001
460 DATA 00384C4C4038
470 DATA 003844447C44
480 DATA 007844784478
490 DATA 003C44404038
500 DATA 007844444478
510 DATA 007C4078407C
520 DATA 007C4078404
530 DATA 003C44404C3C
540 DATA 00444447C4444
550 DATA 003810101038
560 DATA 000404044438
570 DATA 004448704844
580 DATA 004040404070
590 DATA 004460544444
600 DATA 004464544C44
610 DATA 007C4444447C
620 DATA 00784444784
630 DATA 00384444C3C
640 DATA 007844785040
650 DATA 003C40380478
660 DATA 007C1010101
670 DATA 004444444438
680 DATA 00444444281
690 DATA 004454545428
700 DATA 004428102844
710 DATA 00442810101
720 DATA 007C0810207C
730 DATA 001810101018
740 DATA 004020100804
750 DATA 00301010103
760 DATA 00102844
770 DATA 000000000070
780 DATA 001008
790 DATA 00003844443C
800 DATA 004078444478
810 DATA 00003C40403C
820 DATA 00043C44443C
830 DATA 00003844784038
840 DATA 00384070404
850 DATA 0000384444 3C0478
860 DATA 004078444444
870 DATA 00100010101
880 DATA 0004000404044438
890 DATA 004048704844
900 DATA 00301010101
910 DATA 000068545454
920 DATA 000078444444
930 DATA 000038444438
940 DATA 000078444478404
950 DATA 00003C4444 3C0404
960 DATA 00005864404
970 DATA 000038403804 38
980 DATA 002070202038
990 DATA 000044444 43C
1000 DATA 00004444281
1010 DATA 000044545428
1020 DATA 000044283844
1030 DATA 000044444443C047C
1040 DATA 00007C081070
1050 FOR K=33 TO 122
```


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# PROGRAMS

```
1060 READ C$
1070 CALL CHAR(K,C$)
1080 NEXT K
1090 CALL CLEAR
1100 GOSUB 5040
1110 PRINT "         TEEPEETEXPRO
":::::
1120 PRINT "       BY MIKE O'REG
AN"
1130 PRINT "FOR THE T.I. THERMAL
 PRINTER"
1140 PRINT :::::::::
1150 GOSUB 5090
1160 CALL HCHAR(1,1,30,32)
1170 CALL VCHAR(2,1,30,22)
1180 CALL VCHAR(2,32,30,22)
1190 CALL HCHAR(24,1,30,32)
1200 GOSUB 4990
1210 CALL CLEAR
1220 PRINT "99.4 OWNERS PRESS KE
Y 4"
1230 CALL KEY(0,K,S)
1240 IF S=0 THEN 1230
1250 IF K<>52 THEN 1270
1260 TT=1
1270 DIM A$(100)
1280 REM - MASTER MENU
1290 CALL CLEAR
1300 GOSUB 5040
1310 PRINT "        ### MENU ###"
::
1320 PRINT TAB(5);"0.  WRITE TEX
T"
1330 PRINT TAB(5);"1.  DRAFT ON
SCREEN"
1340 PRINT TAB(5);"2.  PRINT FIN
AL DRAFT"
1350 PRINT TAB(5);"3.  DELETE LI
NE"
1360 PRINT TAB(5);"4.  INSERT LI
NE"
1370 PRINT TAB(5);"5.  REPLACE L
INE"
1380 PRINT TAB(5);"6.  REPLACE W
ORD"
1390 PRINT TAB(5);"7.  SAVE ON T
APE"
1400 PRINT TAB(5);"8.  READ FROM
 TAPE"
1410 PRINT TAB(5);"9.  START AGA
IN"
1420 PRINT TAB(5);"?.  INSTRUCTI
ONS":
1430 PRINT TAB(8);"KEY?"
1440 GOSUB 5000
1450 GOSUB 5090
1460 CALL KEY(0,K,S)
1470 IF S=0 THEN 1460
1480 CALL CLEAR
1490 A=K-48
1500 IF K=48 THEN 2030
1510 IF K=49 THEN 4060
1520 IF K=50 THEN 2510
1530 IF (K<54)*(K>50)THEN 1830
1540 IF K=54 THEN 3430
1550 IF K=55 THEN 3890
1560 IF K=56 THEN 3970
1570 IF K=57 THEN 1760
1580 IF K=63 THEN 4740
1590 GOTO 1280
1600 GOSUB 5040
1610 PRINT "PICK CHARACTER SET":
 ::
1620 GOSUB 5000
1630 PRINT TAB(6);"1.PRINTER SET
(LARGE)"
1640 PRINT TAB(6);"2.CUSTOM SET
(SMALL)":::
1650 PRINT "IS YOU PRINTER SWITC
HED ON?":::
1660 GOSUB 5090
1670 CALL KEY(0,KEY,S)
1680 IF S<1 THEN 1670
1690 IF KEY=77 THEN 1290
1700 IF (KEY<49)+(KEY>50)THEN 16
00
1710 IF KEY<>49 THEN 1740
1720 SET$="TP.E"
1730 IF K=49 THEN 4080 ELSE 2530
1740 SET$="TP.U.E"
1750 IF K=49 THEN 4080 ELSE 2530
1760 FOR I=1 TO L
1770 A$(I)=""
1780 NEXT I
1790 L=0
1800 PRINT "FILE NOW BLANK"
1810 GOSUB 4990
1820 GOTO 1290
1830 INPUT "LINE NUMBER?";B
1840 IF (B<1)+(B>L)=-1 THEN 1850
 ELSE 1860
1850 PRINT "NON-EXISTENT LINE"
1860 GOSUB 4990
1870 GOTO 1280
1880 PRINT "OLD LINE #";B
1890 PRINT A$(B)
1900 FOR PSE=1 TO 250
1910 NEXT PSE
1920 ON A GOTO 1290,1290,3220,33
00,1930
1930 PRINT "ENTER REPLACEMENT LI
NE:"
1940 INPUT A$(B)
1950 IF SEG$(A$(B),1,2)<>"BB" TH
EN 1980
1960 A$(B)=" "
1970 GOTO 1280
1980 IF LEN(A$(B))>28 THEN 2180
ELSE 1280
1990 REM -- ENTER TEXT
2000 TEMP=L
2010 L=B
2020 GOTO 2350
2030 GOSUB 5040
2040 PRINT "READY FOR TYPING --
STARTING WITH LINE";L+1
2050 IF TT=1 THEN 2060 ELSE 2070
2060 PRINT "^=UPPER CASE"
2070 PRINT "SLASH(DIVIDE SIGN)=C
OMMA    STAR(MULTIPLY SIGN)=QUOT
ES  DOLLAR SIGN=$#
>=INDENT"
2080 PRINT "N.B. # CUSTOM CHARS
ONLY"
2090 PRINT "BB=BLANK LINE":::
2100 PRINT "KEY-IN ZZ TO FINISH
ENTERINGTEXT":::::
2110 GOSUB 5090
2120 GOSUB 5000
2130 PRINT L+1
2140 IF L+1<>52 THEN 2160
2150 CALL SOUND(1000,440,2,444,2
,448,2)
2160 INPUT A$(L+1)
2170 LC=LEN(A$(L+1))
2180 LL=LC
2190 IF LC>28 THEN 2200 ELSE 225
0
2200 FOR I=LL TO 1 STEP -1
2210 IF SEG$(A$(L+1),I,1)<>CHR$(
94)THEN 2230
2220 LC=LC-1
2230 NEXT I
2240 IF LC>28 THEN 2310
2250 IF LEN(A$(L+1))<1 THEN 2130
2260 IF SEG$(A$(L+1),1,2)="ZZ" T
HEN 1290
2270 IF SEG$(A$(L+1),1,2)<>"BB"
```


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# PROGRAMS

```
THEN 2290
2280 A$(L+1)=" "
2290 L=L+1
2300 GOTO 2130
2310 REM - SHORTEN LONG LINE
2320 REM BELL
2330 CALL SOUND(100,-5,1)
2340 L=L+1
2350 PRINT "LINE TOO LONG -- SHO
RTENED AS SHOWN:"
2360 FOR I=28 TO 1 STEP -1
2370 IF SEG$(A$(L),I,1)=" " THEN
 2420
2380 NEXT I
2390 A$(L)=""
2400 L=L-1
2410 GOTO 2430
2420 A$(L)=SEG$(A$(L),1,I-1)
2430 PRINT A$(L)
2440 IF (TEMP=B)*(TEMP<>0)THEN 2
450 ELSE 2460
2450 L=TEMP
2460 IF A$(L+1)="" THEN 2130
2470 IF (L>TEMP)*(TEMP=0)THEN 12
90
2480 L=TEMP
2490 GOTO 2160
2500 REM -- PRINT TEXT
2510 C=0
2520 GOTO 1600
2530 GOSUB 5000
2540 PRINT TAB(5);"READY TO PRIN
T              CHOOSE FORMAT:"
2550 PRINT "0 = NUMBERED
        1 = SINGLE SPACED
    2 = DOUBLE SPACED"
2560 CALL KEY(0,K,S)
2570 IF S=0 THEN 2560
2580 CALL CLEAR
2590 IF K=77 THEN 1280
2600 B=K-48
2610 IF (K<48)+(K>52)THEN 2540
2620 IF (B<0)+(B>2)THEN 2510
2630 OPEN #1:SET$,OUTPUT
2640 FOR I=1 TO L
2650 P$=A$(I)
2660 IF B<>0 THEN 2680
2670 PRINT #1:I;
2680 IF LEN(P$)=0 THEN 3070
2690 PRINT #1:TAB(3);"";
2700 FOR K=1 TO LEN(P$)
2710 P=ASC(SEG$(P$,K,1))
2720 REM -- CONVERT UNSHIFTED LE
TTERS TO LOWER CASE
2730 IF (P>64)*(P<91)THEN 2740 E
LSE 2760
2740 P=P+32
2750 GOTO 2950
2760 REM -- CONVERT SHIFTED LETT
ERS TO UPPER CASE
2770 IF (P>96)*(P<123)THEN 2780
ELSE 2800
2780 P=P-32
2790 GOTO 2950
2800 REM -- CONVERT SLASH (/) TO
 COMMA (,) - * TO " AND > TO IND
ENT
2810 IF P<>47 THEN 2840
2820 P=44
2830 GOTO 2950
2840 IF P<>42 THEN 2870
2850 P=34
2860 GOTO 2950
2870 IF P<>62 THEN 2900
2880 GOSUB 3110
2890 GOTO 2950
2900 IF P=94 THEN 2910 ELSE 2930
2910 GOSUB 3150
2920 GOTO 2950
```

```
2930 IF P<>95 THEN 2950 ELSE 295
0
2940 GOSUB 3180
2950 PRINT #1:CHR$(P);
2960 REM - TEST FOR BLANK LINE (
BB)
2970 IF (P=66)*(LEN(P$)=2)THEN 3
020
2980 NEXT K
2990 IF B<>2 THEN 3020
3000 PRINT #1
3010 C=C+1
3020 PRINT #1
3030 C=C+1
3040 CALL KEY(0,K,S)
3050 IF S=0 THEN 3070
3060 GOTO 3080
3070 NEXT I
3080 CLOSE #1
3090 CALL SOUND(50,262,0,524,0)
3100 GOTO 1280
3110 PRINT #1:TAB(4);
3120 PRINT TAB(1);
3130 P=32
3140 RETURN
3150 P=ASC(SEG$(P$,K+1,1))
3160 K=K+1
3170 RETURN
3180 PRINT #1:TAB(15);
3190 P=32
3200 RETURN
3210 REM  -- DELETE LINE
3220 L=L-1
3230 FOR I=B TO L
3240 A$(I)=A$(I+1)
3250 NEXT I
3260 A$(L+1)=""
3270 GOTO 1290
3280 REM
3290 REM -- INSERT LINE
3300 L=L+1
3310 FOR I=L TO B+1 STEP -1
3320 A$(I)=A$(I-1)
3330 NEXT I
3340 PRINT "ENTER NEW LINE":
3350 GOSUB 5000
3360 A$(B)=""
3370 INPUT A$(B)
3380 IF SEG$(A$(B),1,2)<>"BB" TH
EN 3400
3390 A$(B)=" "
3400 GOTO 1290
3410 REM
3420 REM -- REPLACE WORD
3430 INPUT"WORD TO BE CHANGED:"
:R$
3440 R$=" "&R$&" "
3450 D=LEN(R$)
3460 IF D>2 THEN 3510
3470 PRINT "ERROR"
3480 FOR PSE=1 TO 250
3490 NEXT PSE
3500 GOTO 3430
3510 N=0
3520 INPUT "NEW WORD?":N$
3530 INPUT "FROM LINE (0=ALL)?":
B
3540 IF B<=L THEN 3570
3550 PRINT "NO SUCH LINE"
3560 GOTO 3530
3570 IF B>1 THEN 3610
3580 C=L
3590 B=1
3600 GOTO 3640
3610 INPUT "THROUGH LINE:":C
3620 IF (C<B)+(C>L)<>-1 THEN 364
0
3630 C=L
3640 PRINT "SEARCHING"
```


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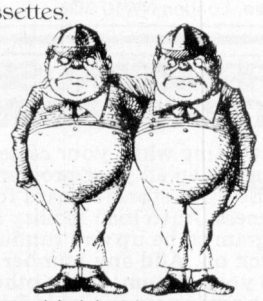
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# PROGRAMS

```
3650 FOR K=B TO C
3660 P$=" "&A$(K)&" "
3670 IF LEN(P$)<D THEN 3740
3680 A=LEN(P$)+1-D
3690 FOR I=1 TO A
3700 IF R$<>SEG$(P$,I,D)THEN 373
0
3710 GOSUB 3780
3720 P$=SEG$(P$,2,LEN(P$)-1)
3730 NEXT I
3740 NEXT K
3750 PRINT N;" CHANGE(S) MADE"
3760 GOSUB 4990
3770 GOTO 1290
3780 CPOS=POS(P$,R$,1)
3790 IF CPOS<>0 THEN 3810
3800 RETURN
3810 T$(1)=SEG$(P$,2,CPOS-1)
3820 T$(2)=SEG$(P$,CPOS+D,LEN(P$
)-1)
3830 P$=T$(1)&N$&" "&T$(2)
3840 A$(K)=P$
3850 N=N+1
3860 PRINT "LINE #";K
3870 PRINT A$(K)
3880 RETURN
3890 PRINT "READY CASSETTE FOR R
ECORDING:"
3900 OPEN #1:"CS1",INTERNAL,OUTP
UT,FIXED 192
3910 PRINT #1:L
3920 FOR I=1 TO L+5 STEP 6
3930 PRINT #1:A$(I),A$(I+1),A$(I
+2),A$(I+3),A$(I+4),A$(I+5)
3940 NEXT I
3950 CLOSE #1
3960 GOTO 1290
3970 PRINT "READY CASSETTE TO RE
AD"
3980 OPEN #1:"CS1",INTERNAL,INPU
T ,FIXED 192
3990 INPUT #1:X
4000 FOR I=L+1 TO X+L+5 STEP 6
4010 INPUT #1:A$(I),A$(I+1),A$(I
+2),A$(I+3),A$(I+4),A$(I+5)
4020 NEXT I
4030 L=L+X
4040 CLOSE #1
4050 GO TO 1290
4060 REM PRINT FINAL TEXT ON SCR
EEN ONLY
4070 C=0
4080 PRINT "CHOOSE FORMAT:": : :
4090 PRINT TAB(8);"0=NUMBERED"
4100 PRINT TAB(8);"1=SINGLE SPAC
ED"
4110 PRINT TAB(8);"2=DOUBLE SPAC
ED": : :
4120 GOSUB 5000
4130 CALL KEY(0,K,S)
4140 IF S=0 THEN 4130
4150 CALL CLEAR
4160 B=K-48
4170 IF (K>48)+(K<52)THEN 4190 E
LSE 4080
4180 IF (B<0)+(B>2)THEN 4070
4190 FOR I=1 TO L
4200 P$=A$(I)
4210 IF B<>0 THEN 4230
4220 PRINT I
4230 IF LEN(P$)=0 THEN 4590
4240 PRINT "";
4250 FOR K=1 TO LEN(P$)
4260 P=ASC(SEG$(P$,K,1))
4270 IF (P>64)*(P<91)THEN 4280 E
LSE 4300
4280 P=P+32
4290 GOTO 4440
4300 IF (P>96)*(P<123)THEN 4310
ELSE 4330
4310 P=P-32
4320 GOTO 4440
4330 IF P<>47 THEN 4360
4340 P=44
4350 GOTO 4440
4360 IF P<>62 THEN 4390
4370 GOSUB 4610
4380 GOTO 4440
4390 IF P<>94 THEN 4420
4400 GOSUB 4640
4410 GOTO 4440
4420 IF P<>95 THEN 4440
4430 GOSUB 4670
4440 PRINT CHR$(P);
4450 CALL KEY(0,KE,ST)
4460 IF ST<1 THEN 4480
4470 GOTO 1280
4480 REM TEST FOR BLANK LINE
4490 IF (P=66)*(LEN(P$)=2)THEN 4
540
4500 NEXT K
4510 IF B<>2 THEN 4540
4520 PRINT
4530 C=C+1
4540 PRINT
4550 P=32
4560 C=C+1
4570 IF C<51 THEN 4590
4580 C=0
4590 NEXT I
4600 GOTO 4700
4610 PRINT TAB(1);
4620 P=32
4630 RETURN
4640 P=ASC(SEG$(P$,K+1,1))
4650 K=K+1
4660 RETURN
4670 PRINT TAB(15);
4680 P=32
4690 RETURN
4700 PRINT "
      PRESS ANY KEY TO CONTINUE"
4710 CALL KEY(0,K,S)
4720 IF S=0 THEN 4710
4730 GOTO 1210
4740 CALL CLEAR
4750 REM INSTRUCTIONS
4760 PRINT "THIS PROGRAM HANDLES
 UP TO  100 LINES OF TEXT": :
4770 GOSUB 4990
4780 IF TT<>1 THEN 4820
4790 PRINT "IT PRINTS IN LOWER C
ASE     (SMALL LETTERS) UNLESS T
OLD OTHERWISE."
4800 GOSUB 4990
4810 PRINT "TO PRODUCE UPPER CAS
E      LETTERS, PRESS '^' BEFOR
E   EACH LETTER.": :
4820 PRINT "99.4A USERS USE SHIF
T KEY TOPRODUCE UPPER & LOWER CA
SE": :
4830 GOSUB 4980
4840 PRINT "TO PRODUCE A BLANK L
INE     PRESS 'BB', OR AN INDENT
'>'"
4850 PRINT "FOLLOWED BY THE APPR
OPRIATE NUMBER OF SPACES": : :
4860 GOSUB 4990
4870 PRINT "IF YOUR TRY TO TYPE
A LINE  WHICH IS TOO LONG THEN Y
OU  WILL BE TOLD THAT THIS IS TO
"
4880 PRINT "BE SHORTENED TO THE
NEAREST WHOLE WORD AND THE NEW L
INE IS DISPLAYED.  LINES WITH"
4890 PRINT "MORE THAT 28 CONTINU
OUS     CHARACTERS(I.E. NO SPACE
S)  WILL BE TOTALLY DISCARDED":
```

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# PROGRAMS

```
: :
4900 GOSUB 4980
4910 PRINT "AFTER 52 LINES YOU W
ILL GET AN AUDIO INDICATION THAT
 YOUHAVE ENOUGH TEXT TO FILL ONE
"
4920 PRINT "SIDE OF AN A4 SHEET
(SINGLE SPACED)": :
4930 PRINT "TEXT PRINTOUT ON SCR
EEN OR  PRINTER MAY BE STOPPED A
T   ANY TIME BY PRESSING ANY KEY
": :
4940 PRINT "PRESS ANY KEY FOR ME
NU"
4950 CALL KEY(0,K,S)
4960 IF S=0 THEN 4950
```

```
4970 GOTO 1280
4980 CALL SOUND(4000,10000,30)
4990 CALL SOUND(4000,10000,30)
5000 FOR BEEP=1 TO 3
5010 CALL SOUND(50,1000,1)
5020 NEXT BEEP
5030 RETURN
5040 FOR DIS=1 TO 12
5050 CALL SCREEN(8)
5060 CALL COLOR(DIS,8,8)
5070 NEXT DIS
5080 RETURN
5090 FOR APP=1 TO 12
5100 CALL COLOR(APP,2,8)
5110 NEXT APP
5120 RETURN
```

## PET Search and Rescue

by Geoffrey Little & Michael Orton

This rather unusual game is based upon a helicopter sea rescue which operates from a lighthouse. Men are rescued from ships which are about to founder on rocks at the base of the lighthouse. The objective is to rescue as many men as possible and then to land safely when the helicopter's fuel runs out.

It runs in 13k on 4000 series PETs and omitting the instructions will halve its volume — which serves as an indication of how comprehensive they are.

The coding is heavily compressed and several points should be noted regarding it. Line 10 must remain in its present position as the first piece of code. This is because the string within it represents an approaching ship and the semicolons (men) are POKEd out of memory where line 10 is stored when the men are removed from the boat. The Boolean algebra used in the program is for checking and each expression returns values of −1 or 0 if a statement is true or false respectively. The waves are produced by randomly cutting a string of waves and printing the two parts in reverse order and the helicopter is decided by a set of three flags designating its rotor position, direction of travel and whether or not a passenger is being carried. These strings are positioned by DIMensioning arrays (A$(X) and D$(Y) which are the X and Y coordinates of the location required. Refuelling from the lighthouse is detected by negating a PEEK (152) which is −1 if the shift key is pressed and 0 otherwise.

As a game it's original and inventive. It's a change to see a game which involves saving people/beings rather than blasting them to bits, and as a program it makes the most of PET's limited graphics and uses Basic to the full. The listing is courtesy of Uckfield School.

```
10 B$="■■        ■ ■■■
```

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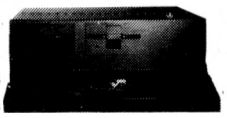
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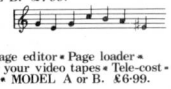
# PROGRAMS

```
290 EX$="
300 C$="
310 C1$="
320 FB$="
330 FORX=1TO9:READHD(X),VD(X):NEXTX
340 FORX=0TO7:READFG(X):NEXTX
350 VV=0:HV=0:VP=6:HP=0:R=0:D=0:M=0:SC=0:FU=500:FH=0:LP=33249:FP=7:GOSUB830
360 I&0$="Y"THENGOSUB1410
370 PRINT"":GOSUB 750
379 :
380 Q=PEEK(151)-48:Q1=(Q<10)*(Q>0)*Q:IFQ=-16THEN490
390 V=VV+VD(Q1):VV=V-.3*((V<-2.1)-(V>2.1)):V=HV+HD(Q1)
400 HV=V-.3*((V<-2.1)-(V>2.1)):FU=IN4((FU-ABS(HV)-ABS(VV+.2)-M)*.995)
410 PRINTD$(23)A$(28)"FU"";:IFFU<.1THENFU=0:GOTO610
420 D=-(HV<0):R=1-R:V=VP:H=HP
430 P=VP+VV:IFP>1THENIFP<22THENVP=P
440 P=HP+HV:IFP>0THENIFP<36THENHP=P
450 PRINTD$(V)A$(H)E$:IFFNC(VP)<>32ORFND(VP)<>32THEN650
460 PRINTD$(VP)A$(HP)H$(R,D,M)
470 IFINT(HP)=0THENIFINT(VP)=6THENIF-PEEK(152)THENGOSUB690
480 GOSUB 790:GOTO380
489 :
490 FU=FU-5:IF-MTHEN560
500 IFFNB(VP+2)<>32THEN390
510 FORP=VP+2TOVP+6:IFFNB(P)=32THENPRINTD$(P)A$(HP+1)"|";:NEXTP
520 IF(FNB(P)AND127)<>59THENM$="|":GOTO540
530 POKE1056+(INT(HP)-INT(BP))+1,32:M$=";":M=1:PRINTD$(21)A$(BP)B$
540 FORP=P-1TOVP+2STEP-1:PRINTD$(P)A$(HP+1)M$;
550 N=20:GOSUB860:PRINT"|":NEXTP:GOTO390
559 :
560 M=0:R=1-R:P=VP+2:PRINTD$(VP)A$(HP)H$(R,D,M)"";
570 IFFNB(P)=32THENPRINT"|";:N=9:GOSUB860:PRINT"";:P=P+1:GOTO570
580 IFP-VP>4ORFNB(P)<>102THENPRINT"SPLAT":N=200:GOSUB860:PRINT"      ":GOTO390
590 SC=SC+1:PRINTD$(23)A$(5)"SC"|";:FORP=33568+HPTO33569STEP-1
600 POKEP,FNF(P)OR59:N=50:GOSUB860:POKEP,FNF(P)OR32:NEXTP:GOTO390
610 IFHP<9THENIFFNB(VP+2)<>32T(EN730
619 :
620 PRINTD$(VP)A$(HP)E$:VV=VV-.3*(VV<.7):VP=VP-VV*((VP+VV)>0):HV=HV*.9:HP=HP+HV
630 )FHP<0ORHP>37ORFNC(VP)<>32ORFND(VP)<>32THEN650
640 PRINTD$(VP)A$(HP)H$(R,D,M):N=20:GOSUB860:GOTO620
649 :
650 PRINTD$(VP)A$(FNE(INT(HP))):FORX=1TO50:PRINTEX$;:NEXTX:PRINTE$
660 GOSUB750:GOSUB790
670 GOSUB790:GOSUB840:GET0$:Q=(Q$="Y")+(Q$="N")*2:Q$="":ON1-0GOTO670,350
680 PRINTD$(11)A$(11)F$:END
689 :
690 IFPEEK(152)=0THENRETURN
700 PRINTD$(23)A$(28)FU"|";:IFFP=0THENFP=8:LP=LP+40
710 I&LP<33569THENFP=FP-1:FU=FU+36:POKELP,FG(FP):GOTO690
720 PRINTD$(13)A$(1)EM$:RETURN
729 :
730 PRIN4D$(VP)A$(FNE(HP))H$(R,D,M)
740 PRINTD$(15)A$(12)"YOU RAN OUT OF FUEL"A$(22)"BUT LANDED SAFELY":GOTO670
749 :
750 PRINT"
760 PRINT"
770 PRINT"
780 PRINTD$(23)"SCORE "SC"|    HELICOPTER FUEL "FU"|";
790 WP=INT(RND(1)*38)+1:PRINTD$(22)MID$(W$,WP)LEFT$(W$,WP-1);
800 BP=BP-RND(1)/3:IFBP<31THENPRINTD$(21)A$(BP)B$
810 PRINTD$(9)L$(L):L=L+1:L=-(L<5)*L:IFINT(BP)<>9THENRETURN
820 PRINTD$(21)A$(BP);:N=150:GOSUB860:P2INTC$;:GOSUB860:PRINTC1$
830 FORX=1057TO1061:POKEX,59:NEXTX:BP=INT(RND(1)*10+30):RETURN
839 :
840 PRINTD$(2)A$(12)"PRESS 'Y' TO RESTART":PRINTD$(4)A$(14)"PRESS 'N' TO STOP"
850 N=50
860 FORZ=1TON:NEXTZ:RETURN
869 :
870 DATA-.3,.3,0,.3,.3,.3,-.3,0,0,0,.3,0,-.3,-.3,0,-.3,.3,-.3
880 DATA160,210,198,192,195,196,197,227
889 :
890 PRINT"      PRESS ANY KEY TO CONTINUE"
900 GET0W$:IF0W$=""THEN900
910 GOSUB920
920 PRINT"TAB(11)"SEARCH & RESCUE":RETURN
930 PRINT"TAB(13)"(C). 1982BY G.J.LITTLE& M.ORTON"
940 0RINT"DO YOU WANT INSTRUCTIONS ? ";
950 GET0$:IF0$=""THEN950
960 0W$="NO":IF0$="Y"THEN0W$="YES"
970 PRINT0W$
980 RETURN
990 GOSUB920
1000 PRINT"   YOU ARE THE PILOT OF A  SEARCH AND "
1010 PRINT" RESCUE HELICOPTER. THE HELICOPTER IS "
1020 PRINT" CONTROLLED USING T(E NUMERIC KEY PAD "
1030 PRINT" AS FOLLOWS:-"
1040 PRINT"  7  8  9    THE '5' KEY HAS NO EFFECT"
1050 PRINT"   \ | /     AND THE OTHERS ACCELERATE"
1060 PRINT"    -        YOU  IN  THE  DIRECTI/N"
1070 PRINT"  4-  -6    RELATIVE  TO  THE '5' KEY"
1080 PRINT"             FOR  AS LONG AS THEY  ARE"
1090 PRINT"   / | \     DEPRESSED."
1100 PRINT"  1  2  3"
```

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# PROGRAMS

```
1110 PRINT"   ØOTHER CONTROLS  ARE THE ØSHIFT■  KEY"
1120 PRINT" AND THE ØSPACE■ BAR."
1130 PRINT" THE ØSHIFT■  +EY  OPERATES  REFUELLING "
1140 PRINT" FROM THE TOP  OF THE LIGHTHOUSE ONLY,"
1150 PRINT" IT IS  0OSSIBLE  TO  RETURN  TO  THE "
1160 PRINT" LIGHTHOUSE TO  REFUEL DURING SORTIES."
1170 RETURN
1180 GOSUB890
1190 GOSUB920
1200 PRINT"Ø   THE  ØSPACE■ BAR  OPERATES  THE  ROPE,"
1210 PRINT" DROPPING  THE  PASSENGER  WHEN ONE IS"
1220 PRINT" CARRIED OR LOWERING THE ROPE WHEN ONE"
1230 PRINT" IS NOT."
1240 PRINT"   THE  IDEA  IS  TO  MANOEUVRE  THE "
1250 PRINT" HELICOPTER ABOVE TH% APPROACHING SHIP"
1260 PRINT" AND  LOWER THE  ROPE  ONTO ONE OF THE "
1270 PRINT" MEN ON DECK, W(O  WILL THEN CLIMB  UP"
1280 PRINT" INTO THE HELICOPTER. TO BRING THE MAN"
1290 PRINT" TO SAFETY 9OU MUST AGAIN MANOEUVRE SO"
1300 PRINT" THAT YOU ARE SITUATED  ABOVE THE ROCK"
1310 PRINT" PLATFO2M NEXT TO THE LIGHTHOUSE. THEN"
1320 PRINT" SIMPLY DEPRESS THE ØSPACE■  BAR TO DROP"
1330 PRI.T" THE PASSENGER  WHO WILL THEN RUN INTO"
1340 PRINT" THE LIGHTHOUSE."
1350 PRINT"   IF  YOU  BEG)N  TO RUN  LOW ON FUEL,"
1360 PRINT" MOVE THE  HELICOPTER TO BE STATIONARY"
1370 PRINT" ABOVE THE  HELICOPTER PLATFORM (START"
1380 PRINT" POSITION) AND  DEPRESS  THE ØSHIFT■ KEY"
1390 PRINT" UNTIL YOU THINK YOU HAVE ENOUGH FUEL."
1400 RETURN
1410 GOSUB890
1420 PRINT"Ø ØPOINTS TO NOTE■:-"
1430 PRINT"Ø   THE  RATE  OF  FUEL  CONSUMPTION  IS"
1440 PRINT" RELATED TO THE AMOUNT O& FUEL  CARRIED,";
1450 PRINT" CARRYING  A  PASSENGER,  LOWERING  THE"
1460 PRINT" ROPE AND YOUR SPEED."
1470 PRINT"   THE  KEYS  ACCELERATE  YOU. THUS, TO"
1480 PRINT" CHANGE  DIRECTION YOU WILL  SLOW  DOWN,";
1490 PRINT" TURN AROUND AND THEN ACCELERATE."
1500 PRINT" PASSENGERS BEING FAIRLY F2AGILE CANNOT"
1510 PRINT" BE  DROPPED  ABOVE  THE  HEIGHT OF THE"
1520 PRINT" LOWEST LIGHTHOUSE WINDOW."
1530 PRINT"   WHEN YOU RUN OUT OF FUEL, IF YOU ARE"
1540 PRINT" POSITIONED  ABOVE  THE  HE,ICOPTER, OR"
1550 PRINT" ROCK PLATFORM YOU WILL LAND SAFELY."
1560 GOSUB890
1570 BP=25:GOSUB750
1580 FI$="┬┬■":FD=8:FA=0:FQ$="HELICOPTER PAD":FL=24:GOSUB1660
1590 FI$=" ▮▮ ▮▮ ▮▮ ▮▮ ▮▮ ▮▮ ▮▮ ":FD=12:FA=1:FQ$="FUEL GUAGE":FL=25:GOSUB1660
1600 FI$="O":FD=18:FA=2:FQ$="MINIMUM HEI'HT FOR DROPPING MAN":FL=24:GOSUB1660
1610 FI$="▒▒▒▒▒▒▒▒":FD=21:FA=0:FQ$="ROCK PLATFORM":FL=24:GOS5B1660
1620 FI$=",":FD=20:FA=26:FQ$="MEN":FL=25:GOSUB1660
1630 PRINTD$(5)A$(9)"PRESS ANY KEY TO START"
1640 GETQW$:IFQW$=""THEN1640
1650 RETURN
1660 PRINTD$(5)A$(19-LEN(FQ$)/2)FQ$
1670 FORX=1TOF,:PRINTD$(FD)A$(FA)F$(FR)FI$:FR=1-FR:N=99:GOSUB860:NEXTX
1680 PRINTD$(5)A$(19-LEN(FQ$)/2)LEFT$(FB$,LEN(FQ$)):RETURN
READY.
```

## Atari Colour Selector

by Derek Lees

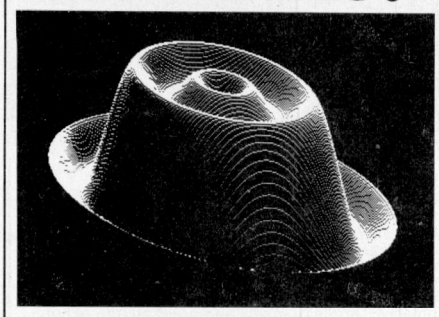
The colour graphics on the Atari 400/800 allow for a vast number of screen combinations. In Atari Basic text mode 0, 16 foreground colours, with eight possible luminosities can be combined with a similar selection of border colours. Added to those, eight text brightnesses can be chosen.

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```
1 REM .  GRAPHICS 0 COLOUR UTILITY
2 REM .  D.J.LEES, AUGUST 1982
3 REM .  -------------------------
4 REM .  USE BREAK KEY TO TERMINATE
5 REM .  -------------------------
```


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# PROGRAMS

```
10 INTRO=800:FGND=200:BDR=300:TEXT=400:I
NFO=600:BLINK=700:N16=16
15 GOSUB INTRO
20 GRAPHICS 0:POKE 752,1:POKE 712,148:PO
KE 82,0:POKE 83,40:OPEN #1,4,0,"K:"
23 ? :? " Cntl-Q, Cntl-R 37 times, Cntl-E
   "
25 ? "  |Number Colour     Number Colour
   |"
26 ? "  |
   |"
30 ? "  |  0    GREY         08   LIGHT-BL
UE  |"
35 ? "  |  1    GOLD         09   BLUE-GRE
EN  |"
40 ? "  |  2    ORANGE       10   AQUA
   |"
45 ? "  |  3    RED          11   GREEN-BL
UE  |"
50 ? "  |  4    PINK         12   GREEN
   |"
55 ? "  |  5    VIOLET       13   YELLOW-G
REEN|"
60 ? "  |  6    BLUE-PURPLE  14   ORANGE-G
REEN|"
65 ? "  |  7    BLUE         15   ORANGE
   |"
70 ? "   Cntl-Z, Cntl-R 37 times, Cntl-C
   "
75 GOSUB BLINK
80 POSITION 1,16:? "SE.1,0,":POSITION 14
,16:? "SE.2,":POSITION 21,16:? ",":POSIT
ION 27,16:? "SE.4,":POSITION 34,16:? ","
85 POSITION 1,18:? "ADDR.709=":POSITION
14,18:? "ADDR.710=":POSITION 27,18:? "AD
DR.712="
90 C1=INT(PEEK(709)/N16):L1=PEEK(709)-C1
*N16
95 C2=INT(PEEK(710)/N16):L2=PEEK(710)-C2
*N16
100 C4=INT(PEEK(712)/N16):L4=PEEK(712)-C
4*N16
110 GOSUB INFO
125 GET #1,CHOICE
130 IF CHOICE=70 THEN 150
135 IF CHOICE=66 THEN 155
140 IF CHOICE=84 THEN 160
145 GOTO 125
150 GOSUB FGND:GOSUB BLINK:GOTO 125
155 GOSUB BDR:GOSUB BLINK:GOTO 125
160 GOSUB TEXT:GOSUB BLINK:GOTO 125
190 REM ***FOREGROUND COLOUR***
200 POSITION 2,20:? "Hit SPACE to alter
FOREGROUND Colour"
205 POSITION 2,21:? "Hit ESCAPE Key to f
reeze parameters "
210 GET #1,K:IF K=32 THEN C2=C2+1:GOTO 2
25
215 IF K=27 THEN POSITION 21,20:? "the B
RIGHTNESS    ":GOTO 240
220 GOTO 210
225 IF C2>15 THEN C2=0
```


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# PROGRAMS

```
230 SETCOLOR 2,C2,L2:GOSUB INFO:GOTO 210
240 GET #1,K:IF K=32 THEN L2=L2+2:GOTO 2
55
245 IF K=27 THEN 270
250 GOTO 240
255 IF L2>14 THEN L2=0
260 SETCOLOR 2,C2,L2:GOSUB 600:GOTO 240
270 POSITION 2,20:? CHR$(156):POSITION 2
,20:? CHR$(156)
275 RETURN
290 REM ***BORDER COLOUR***
300 POSITION 4,20:? "Hit SPACE to alter
BORDER Colour"
305 POSITION 4,21:? "Hit ESCAPE to freez
e parameters "
310 GET #1,K:IF K=32 THEN C4=C4+1:GOTO 3
25
315 IF K=27 THEN POSITION 22,20:? " BRIG
HTNESS   ":GOTO 340
320 GOTO 310
325 IF C4>15 THEN C4=0
330 SETCOLOR 4,C4,L4:GOSUB INFO:GOTO 310
340 GET #1,K:IF K=32 THEN L4=L4+2:GOTO 3
55
345 IF K=27 THEN 370
350 GOTO 340
355 IF L4>14 THEN L4=0
360 SETCOLOR 4,C4,L4:GOSUB INFO:GOTO 340
370 POSITION 4,20:? CHR$(156):POSITION 4
,20:? CHR$(156)
375 RETURN
390 REM ***TEXT BRIGHTNESS***
400 POSITION 3,20:? "Hit SPACE to alter
TEXT brightness"
405 POSITION 3,21:? "Hit ESCAPE to freez
e parameters   "
410 GET #1,K:IF K=32 THEN L1=L1+2:GOTO 4
25
415 IF K=27 THEN 440
420 GOTO 410
425 IF L1>14 THEN L1=0
430 SETCOLOR 1,0,L1:GOSUB INFO:GOTO 410
440 POSITION 4,20:? CHR$(156):POSITION 4
,20:? CHR$(156)
445 RETURN
590 REM ***DATA UPDATE***
600 POSITION 9,N16:? "   ":POSITION 9,N16
:? L1:POSITION 19,N16:? "   ":POSITION 19
,N16:? C2:POSITION 22,N16:? "   "
610 POSITION 22,N16:? L2:POSITION 32,N16
:? "   ":POSITION 32,N16:? C4:POSITION 35
,N16:? "   ":POSITION 35,N16:? L4
615 POSITION 10,18:? "    ":POSITION 10,1
9:? PEEK(709):POSITION 23,18:? "    ":POS
ITION 23,18:? PEEK(710)
620 POSITION 36,18:? "    ":POSITION 36,1
8:? PEEK(712)
630 RETURN
690 REM ***BLINK INVERSE VIDEO***
700 POSITION 1,14:? "SELECT (T)ext,(F)or
eground, or(B)order"
```


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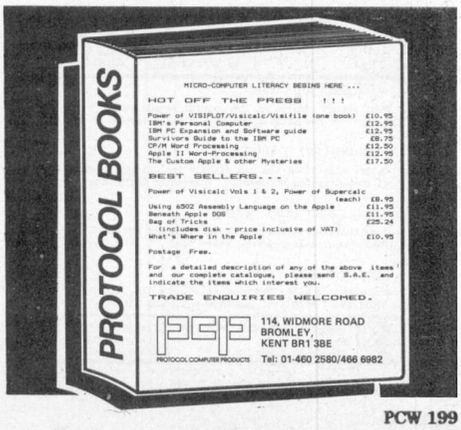
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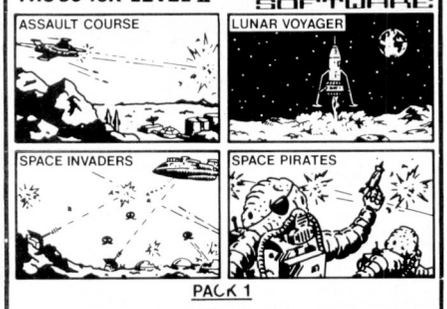
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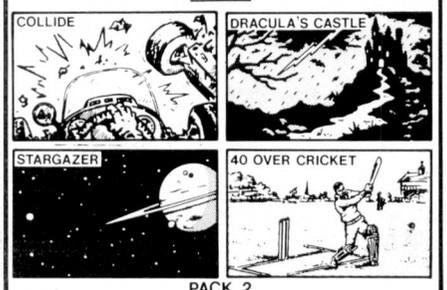
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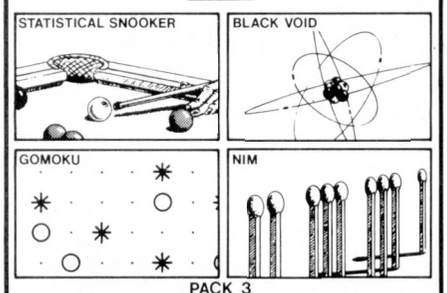
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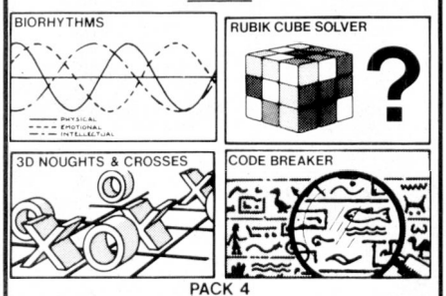

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# PROGRAMS

```
710 NORM=PEEK(755)
715 FOR W=0 TO 5
720 FOR DELAY=0 TO 10:NEXT DELAY
725 POKE 755,0:SOUND 1,50,10,10
730 FOR DELAY=0 TO 10:NEXT DELAY
735 POKE 755,2:SOUND 1,0,0,0
740 NEXT W:POKE 755,NORM
745 RETURN
790 REM ***INTRODUCTION***
800 ? "}":DIM A$(18):POKE 752,1
805 A$="DJL COLOUR UTILITY"
810 FOR J=0 TO 22:POSITION J,J
815 ? A$:POKE 710,J*8:POKE 712,J*4:SOUND
 0,J,10,10:FOR W=0 TO 5:NEXT W:NEXT J
820 SOUND 0,0,0,0:RETURN
```

# EPSON HX20

*Continued from page 117*

stock control applications is also promised which will be HP compatible.

The RS232 interface can be used to attach a full-sized printer such as Epson's own MX-100 for which the protocols are built-in (though the interface is programmable to accommodate other devices). An acoustic coupler, the CX-20, will be available at launch, Telecom permitting, which will make the HX-20 into a powerful roving terminal for sales teams and the like.

Floppy disk drives are to be produced ; twin 5¼in drives with 328k per drive. They will be controlled by the TV adaptor, but don't expect to see them before 1983.

An obvious question given the excellent keyboard is 'Can I word-process on it?' The answer is that Epson has commissioned a word-processing package called 'Correspondent' and a mailing list program called 'MList', both of which should be available on launch; unfortunately I couldn't get them in time for this test. 'Correspondent' will be distributed in ROM and Epson sounds quite excited about its capabilities. More than that I cannot tell you.

Other software products which Epson has in preparation are a spreadsheet program called 'Epsoncalc', a Sales Order package which takes orders, gives receipts and can communicate to the base computer, and 'Personal Office', which is a calendar/diary/alarm program with card file style data storage facilities; this should close the gap with the HP75C referred to above.

A very interesting sounding package is 'DIY', which is claimed to allow businessmen to write their own software in plain English. Something along the line of Sord's PIPS perhaps, or maybe a program generator?

## Conclusion

I feel rather shell shocked having reviewed the HX-20 so soon after the excellent HP75C. Both machines advance the art of portable computing beyond recognition — if in subtly different directions. The Epson is rather more like a conventional desk-top micro in its functioning than the HP is. It is aimed either at the business user who will buy ready made software on tape or in ROM packs, or at the owner-programmer who will write most of his/her own software. There is not much you can do with the naked machine — unlike the HP which has lots of 'super-calculator' firmware for the busy executive. On the other hand, the Epson is at least the equal of the HP in power and leaves it standing in the quality of its keyboard and the convenience of its built-in printer and tape drive. It is also very substantially cheaper.

When a decent word processing package can be had for it then writing on the train or aeroplane can become an affordable reality at last, even if you do have to take it home to print it. For journalists and for business letters 32k is quite enough memory for away-from-base use to be a practical proposition.


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For tasks such as stock-control, sports result calculations, and sales records as well as general engineering and scientific work it is an excellent tool and an impressively well made one at that. Given Epson's marketing clout (how many computer shops do you know who don't sell Epson printers) I expect to see a lot of them about in 12 months' time and this also bodes well for a supply of third party software; from previous experience of Japanese firms I wouldn't expect a lot of software support from the manufacturer but Epson does seem to be trying to do things differently. The choice of a 6800 look-alike chip is rather unfortunate as it will definitely hinder the conversion of many existing programs but I expect it to open up whole new areas of application where this is not so relevant.

I wouldn't mind finding one in my stocking, anyway.

## Prices

| | |
|---|---|
| Epson HX-20 (including battery charger) | £402 |
| same but with travelling case | £411 |
| Microcassette Drive | £ 75 |
| Expansion Memory Unit | £ 80 |
| ROM cartridges | £ 45 |
| TV/Monitor Adapter | na |
| Barcode Reader | £ 82 |
| Acoustic Coupler CX-20 | na |
| Rolls of printer paper | 50p |
| Ribbon cartridge | £2.20 |

All prices excluding VAT

## Benchmark timings

| | |
|---|---|
| BM1 | 2.7 |
| BM2 | 15.3 |
| BM3 | 33.1 |
| BM4 | 32.8 |
| BM5 | 35.3 |
| BM6 | 59.1 |
| BM7 | 100.6 |
| BM8* | 133.3 |

*All timings in seconds. For a full explanation of Benchmarks see* PCW *November 1982.*
**Note: BM8 now counts 1000 loops.*

# PLUTO POWER!

*Continued from page 130*

used to fill in the area. This area can be of any complex shape (hence the name) and is filled in extremely quickly.

## Documentation

The manual for the Pluto can only be described as sparse and consists of 17 pages, all printed on a dot matrix printer. It is generally badly written, especially from the point of view of a computer novice, and contains many typing errors. The comment which describes the attitude of the manual is 'Try it and see.' The only demonstration is given by a small sample program at the back which is written in Z80 machine code (and contains some bugs). I can only conclude that the manual was a provisional copy to be replaced later as it in no way matches the standards of the software and hardware.

## Future developements

There seems to a very good development programme under way at IO Research which will soon bring out versions of the Pluto card to enable it, with the aid of a new version of the on-board software, to draw arcs, circles (and ellipses to allow for different aspect ratios), do simple polyfills (a very fast way of filling concave shapes), boundary fill, simple boundary fill, 90-, 180- and 270-degree rotation during copy and a character polyfill.

There is now a function to allow the definition of a two-dimensional mask which is used when filling in a rectangle or complex polygon and allows the existing shape to be filled with the bit pattern in the mask which is smaller than the shape to be filled (ie, it propagates a shape throughout the area of memory). The best use of this function is the definition within the mask of a coloured bit pattern. This will give the visual appearance of a new set of colours/textures, depending on the bit pattern in the mask.

The new software has also been completely rewritten to increase the speed of all the functions dramatically. There will also be a facility to download your own programs to be run by the 16-bit processor on the Pluto board. There is also a simple debugging aid incorporated within the new software to allow you to set breakpoints and single step downloaded programs.

Then there's a version, which has just been released, that has interlace. This means that the beam on the screen performs one scan and then, instead of returning to the original position, does a second scan in between the lines already drawn. This will therefore give twice as much resolution on the screen (640 x 576) as the normal un-interlaced mode. However, in order to have this facility, one screen must be lost, hence losing the ability to have screen swit-


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ching and therefore rapid animation (the screen partitions are redefined so that partition 1 handles the top half of the screen while 2 handles the bottom half of the screen). If animation is required the interlace can be switched off to return to the normal mode.

The 'Palette Board' will act like a large board into which a various number of RAM chips can be plugged. This means that the full complement of memory will be available to the 8088 and then, while keeping the resolution the same, all 24 bits (from the address line) can be used for the colours all of which can be displayed in any combination of 256 colours (one byte per pixel). However with the palette board you can no longer use a RGB monitor with TTL inputs. To obtain the full colour range you would have to use a RGB monitor equipped with analogue inputs; this is because the variations in colours can be obtained only be altering the input voltages to the individual colour inputs to the monitor through stepped increments of one two-hundred-and-fifty-sixth of the voltage swing (whereas a TTL colour monitor works on a binary input of 0 volts Low and 5 volts High). This requirement for very accurate stepping in voltages to obtain the gradations in colours is why the palette board will once again be available, like the Pluto card, in more than one option — eg, cheaper but fully upgradable systems. To complement the palette board IO is producing a 'frame grabber'. This is a piece of hardware which will enable a standard TV picture to be digitised and displayed from a TV camera or video recorder. This is an option that a lot of TV advertising companies have been after for a long time as it makes image processing very cheap.

## Conclusions

The Pluto board seems an exciting development in the area of computer graphics for the micro market, although it can quite easily be used as an intelligent high resolution colour text/graphics terminal emulating any protocol, such as Tectronix. The Pluto system should appeal to both the hobbyist (because of the system being available in so many upgradable versions and hence not damaging the pocket too much when starting off) and to the professional because of the vast amounts of colours and hardware options: IO Research is willing to do hardware interfaces (or supply details on how to do it), on request, for any machine. Just imagine it, a 16-million-colour high resolution graphics board with a 16-bit processor, all run from a ZX81! (Yes! They will do it.) The most critical comment about the Pluto card is the amount of time and program space taken up through sending all those command and data bytes; though this could not be described as a fault of the Pluto's. This problem can quite easily be overcome by writing a small interpreter program. In fact CCSoft (the people who brought out the graphics software for the Mimi and the IVC card) are now bringing out a version to communicate to the Pluto board. This software should be able to be linked into a Basic program and hence make graphic operations much simpler.

It is without doubt a very versatile machine which, with all the development being planned, can only do well and is certainly capable of being extended even further.

## Prices

| | |
|---|---|
| Baby Pluto | £299 |
| Pluto | £399 |
| Boxed Pluto + interface | £599 |
| Dble resolution (interlaced) option | £ 50 |
| 8 MHz option | £ 50 |
| | (add VAT) |

Note: IO Research will perform any of the upgrades free of charge; you need only pay for the parts.

*We must extend our warm thanks to GJ Brain of Gradepoll Ltd, formerly Braintech, for loaning the Galaxy 1 and Pluto board.*

# DATABASE COMPARISON

*Continued from page 143*

dBaseII and Condor the easiest in that respect. Clarity and 'naturalness' is another important virtue, and another pretty subjective one, but there are some rules. For instance, I found the DMS menu — which for example uses the letter 'C' as its prompt for Keyed access, and 'K' for another function — very confusing. I also found the Cardbox three-tier naming very confusing in an otherwise highly 'natural' package.

Finally, taking a look at the manual is always a good indicator of what the package is like. Every package should, I think, have a Tutorial Guide for beginners, a Reference Manual for experienced users and a Prompt Card for reminding people about particular command formats. The Cardbox manual is extremely good in all those areas, I

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thought; personally I also like the dBaseII approach of an initial manual written by an experienced user to complement the reference manual, with lots of examples — another must. The Silicon Office manual is also, I think very good.

## Conclusions

I've tried throughout to view each package as having a niche in the market, and to think in terms of 'horses for courses' rather than plumping for just one or two. I still think that's the right approach, and I hope this article will help you to make up your own mind about what's best for you.

I would like to thank the suppliers of all the packages and systems I've reviewed for their cooperation. I would also like to thank particularly all the staff at Westwood Computers in Birmingham (especially Neil and Wanda Weigel and Sue Alexander), and Keith Frewin and Simon McCarthy of Small Systems Engineering, for considerable help and support.

# LEISURE LINES

*by J J Clessa*

Merry Christmas to all — here are two harder-than usual problems.

## Quickie

What is special about the number 8,549,176,320?

No answers — no prizes.

## Prize puzzle

A difficult puzzle this month, since it's Christmas and everyone will have extra leisure time to work at their micros.

Every odd number, except two, between 1 and 8999 is either a prime or the sum of a prime and twice a square.

Thus:

$321 = 19 + 2.1^2$

$27 = 19 + 2.2^2$

What are the two exceptions?

## September prize puzzle

What a lot of coconuts — and what a lot of entries! Well over 300 replies were received for this puzzle, which is a variation on an old chestnut. Answers received ranged from two coconuts (yes — *two*) to millions and millions.

The correct answer is 279,931 coconuts, which is the smallest positive solution. Although a solution by micro isn't too difficult, an analytical approach can also be used. Since -5 is clearly a solution, then adding or subtracting multiples of $6^7$ (six men, seven share-outs) to -5 gives all possible answers. Hence the smallest is $-5 \times 6^7$ which is 279,931.

The winning entry came from S Matcher of Havant. Congratulations, Mr Matcher, your prize will be with you forthwith — if not sooner.

By the way, remember *postcards* (or backs of envelopes) only. All other entries go straight into the bin — you have been warned.

# BLUDNERS



In our review of Keele Codes' E40 data compression program in the September issue we gave out a phone number which is no longer appropriate. Keele Codes can be reached on 0782 629221.

A program named 'The Walls' appeared in the November issue with the end of one line missing. The last statement in line 4130 should read 'NEXT A'.


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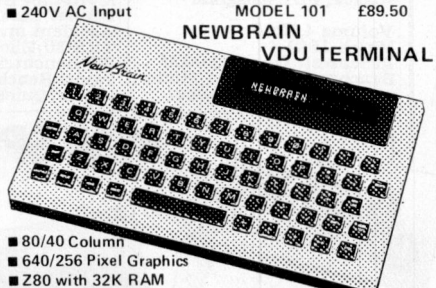


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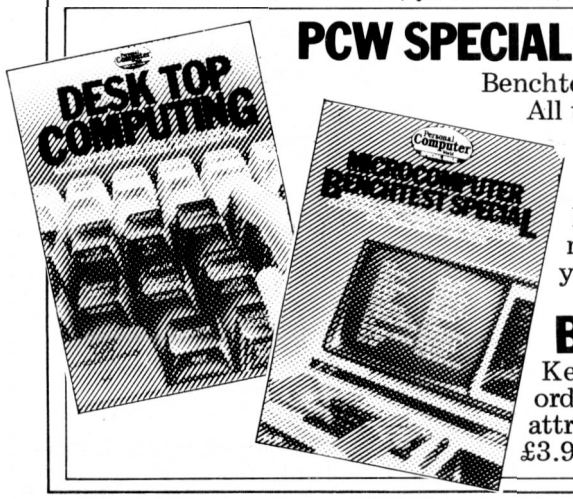

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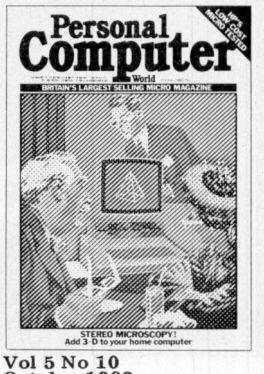

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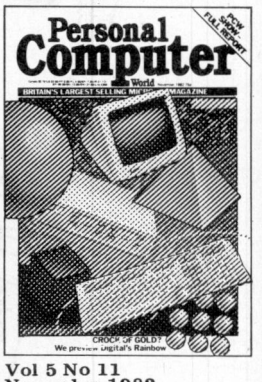

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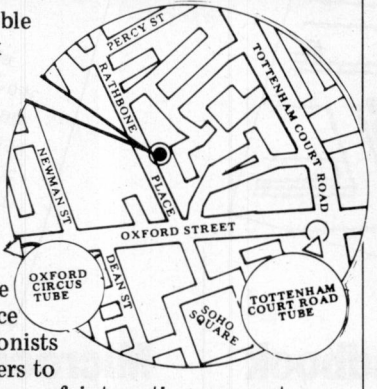

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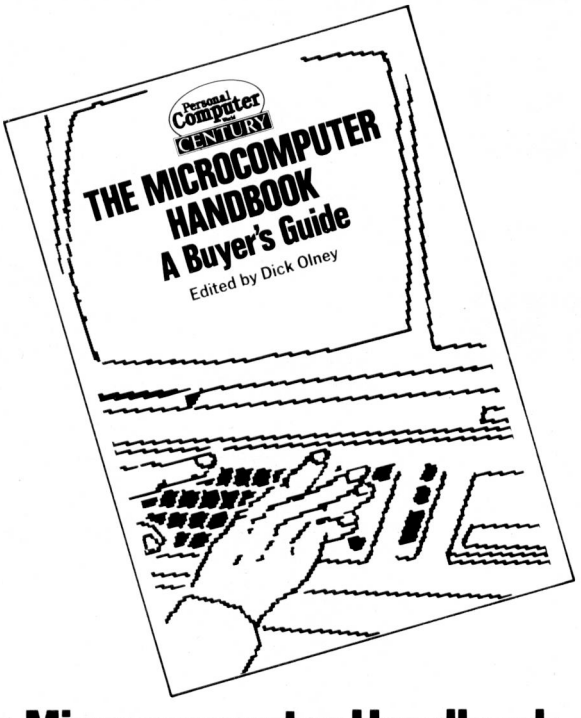
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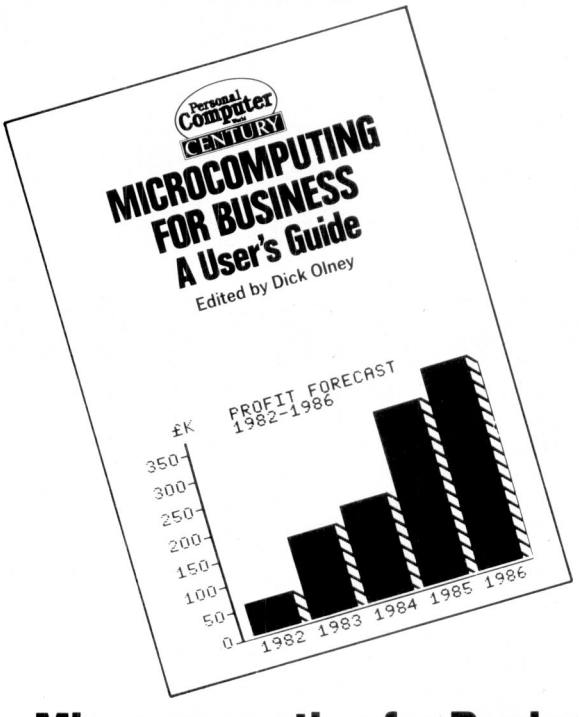

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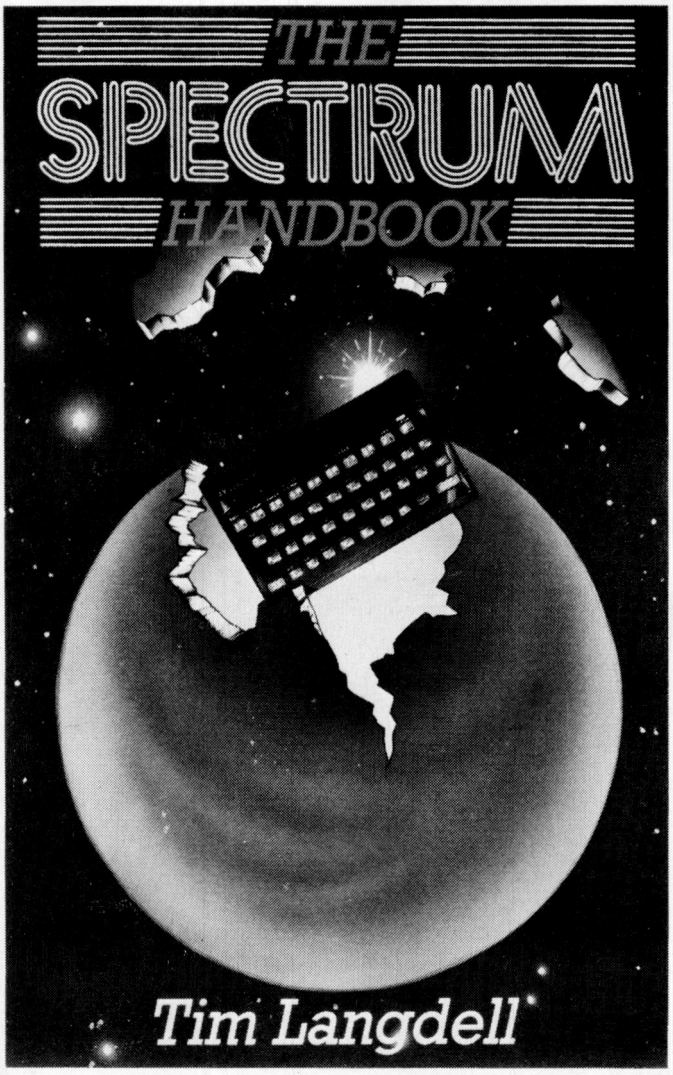
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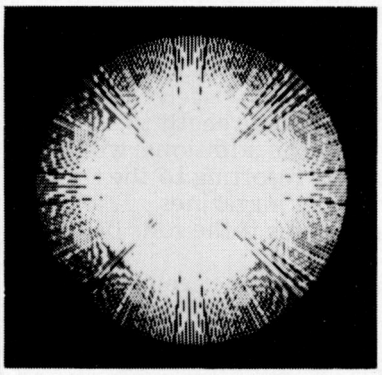
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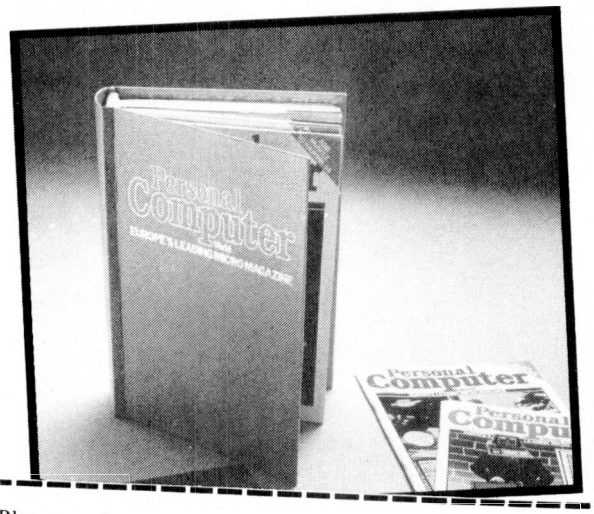
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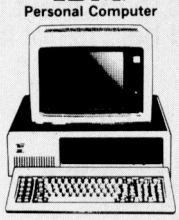
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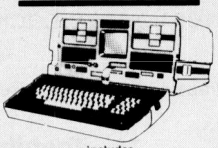
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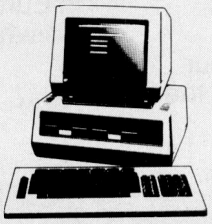


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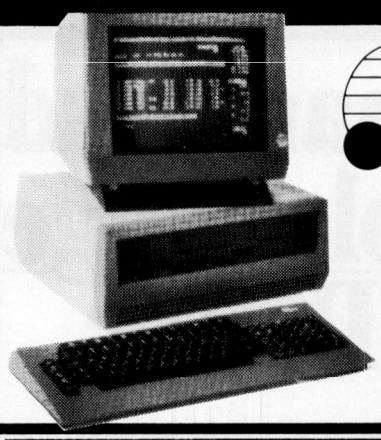
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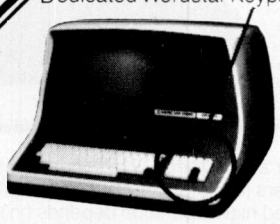
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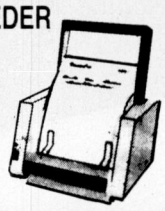
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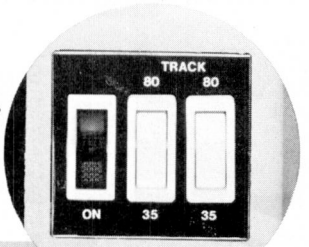
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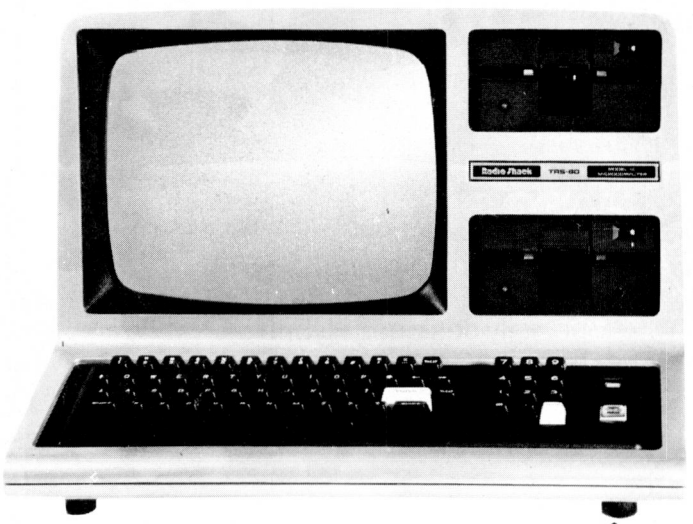
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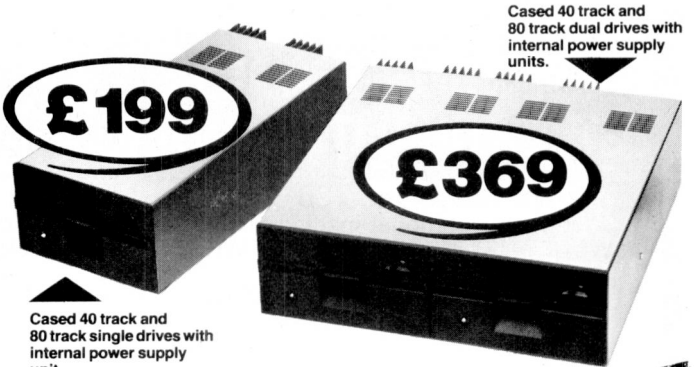
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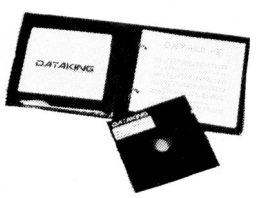
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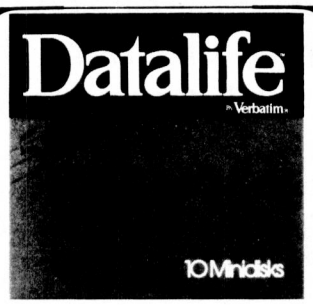
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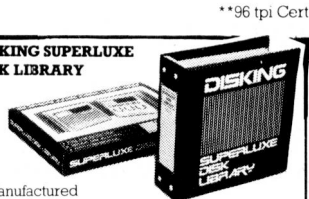


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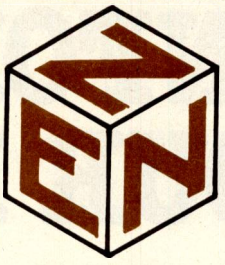
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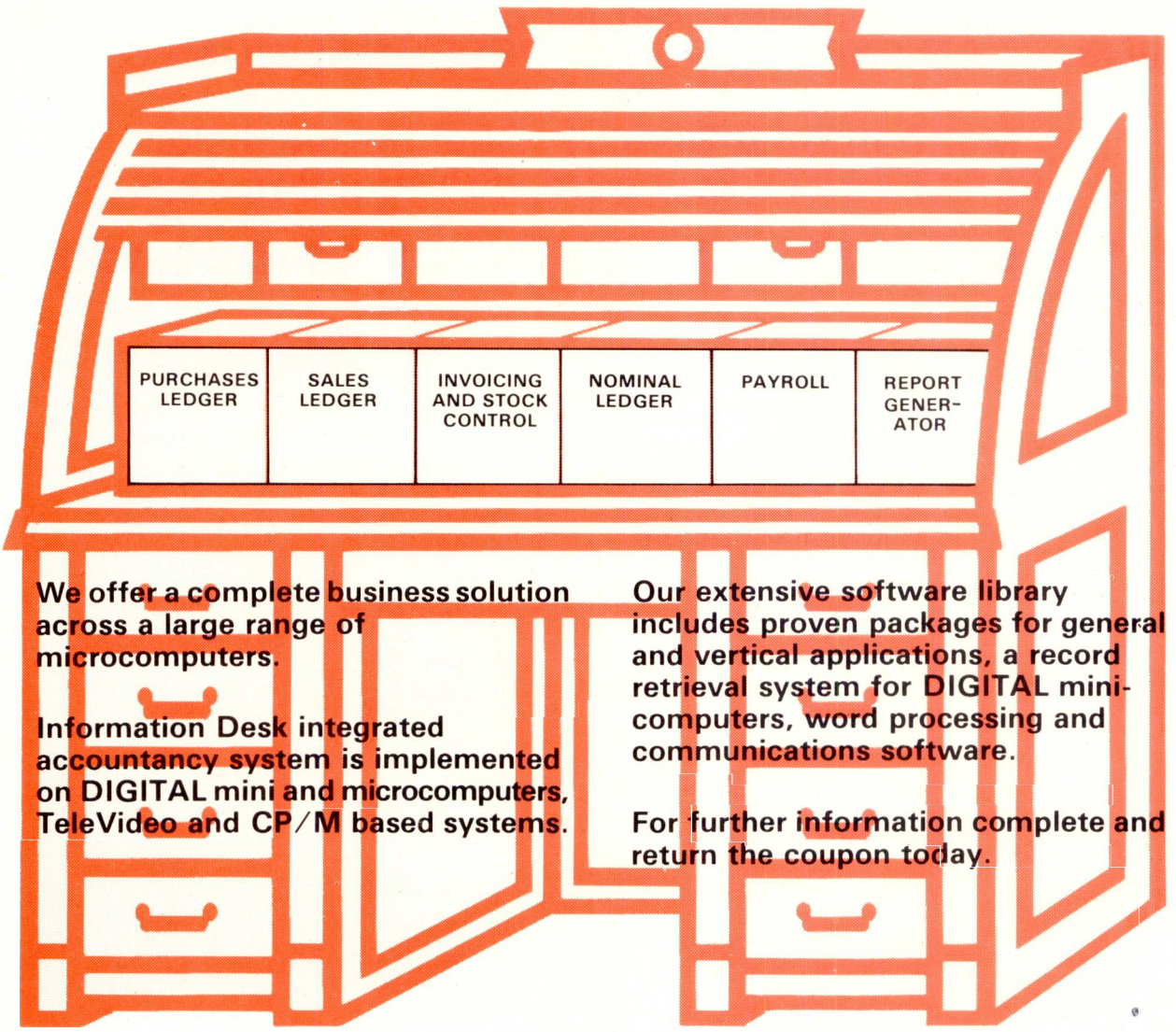
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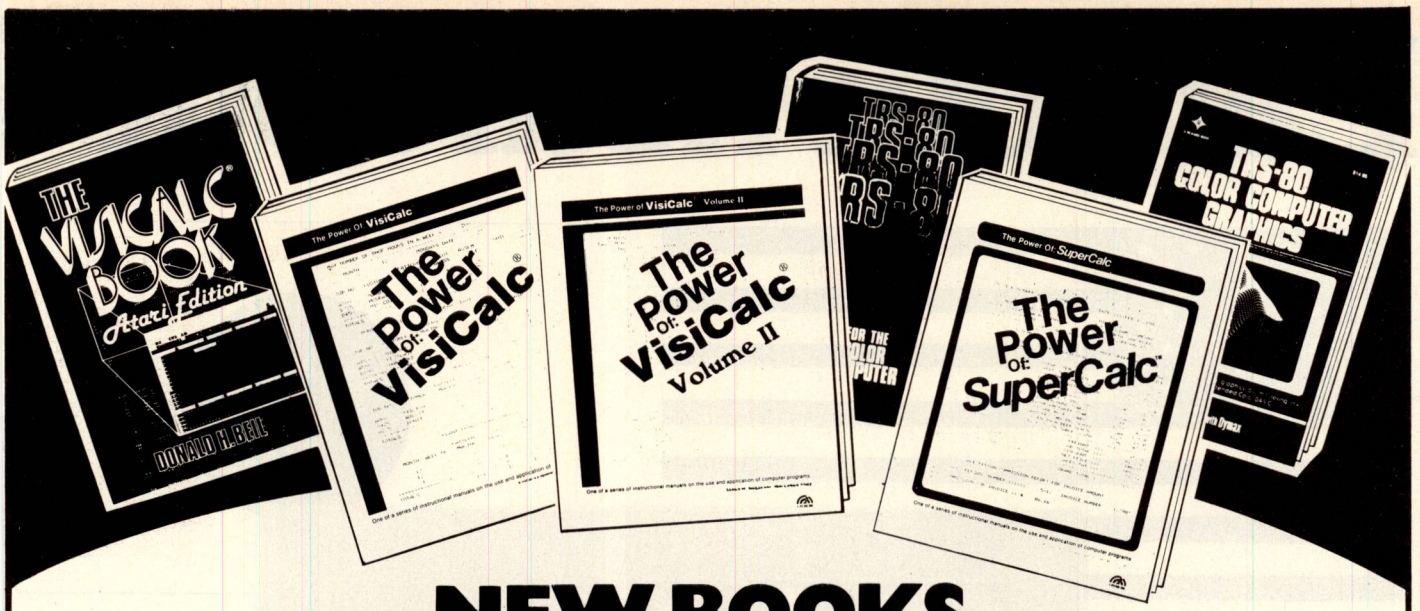
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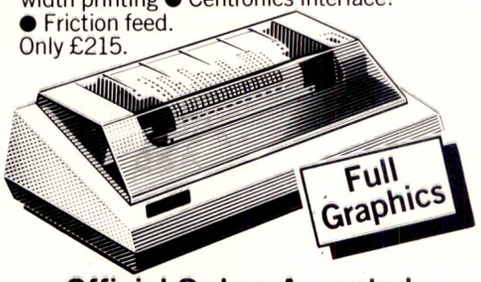
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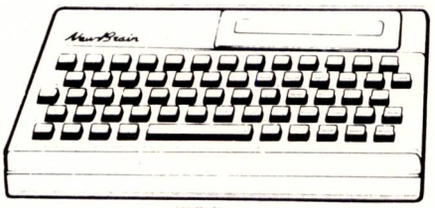
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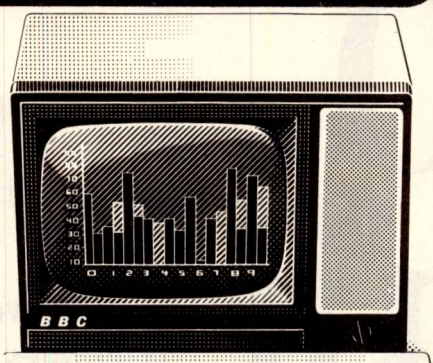
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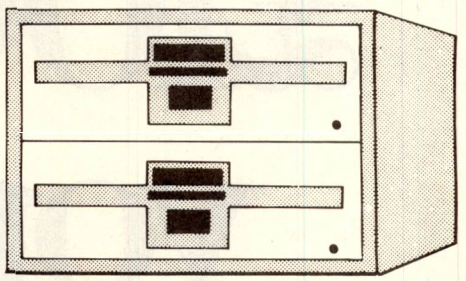
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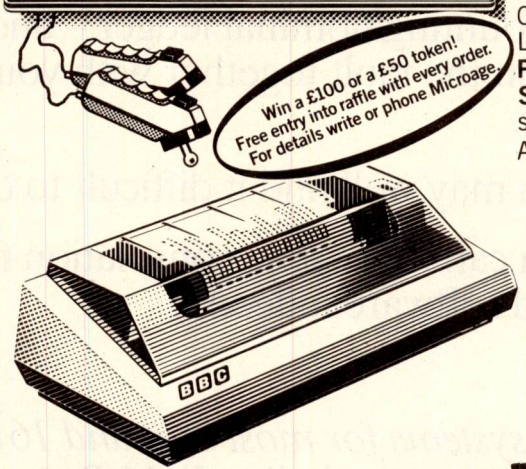
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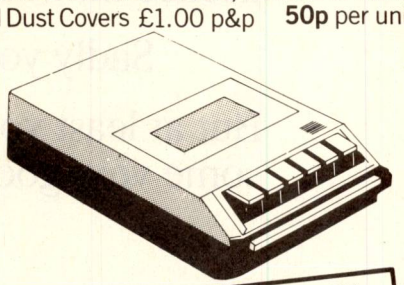







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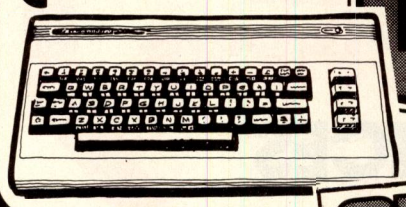
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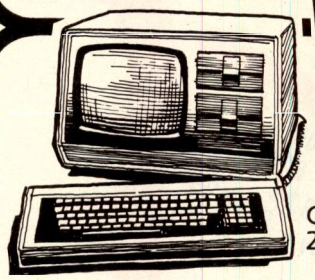




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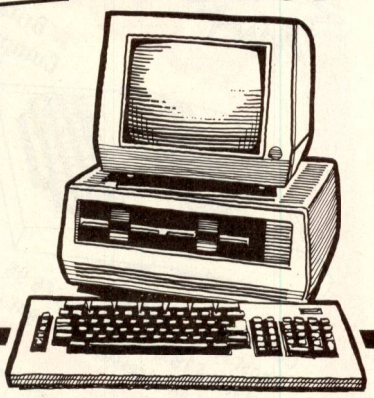


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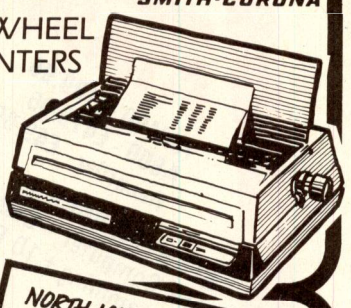
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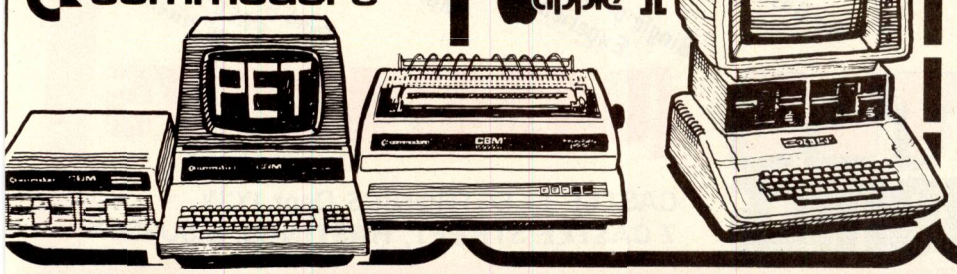
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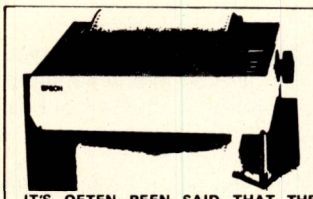
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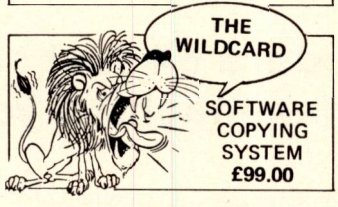
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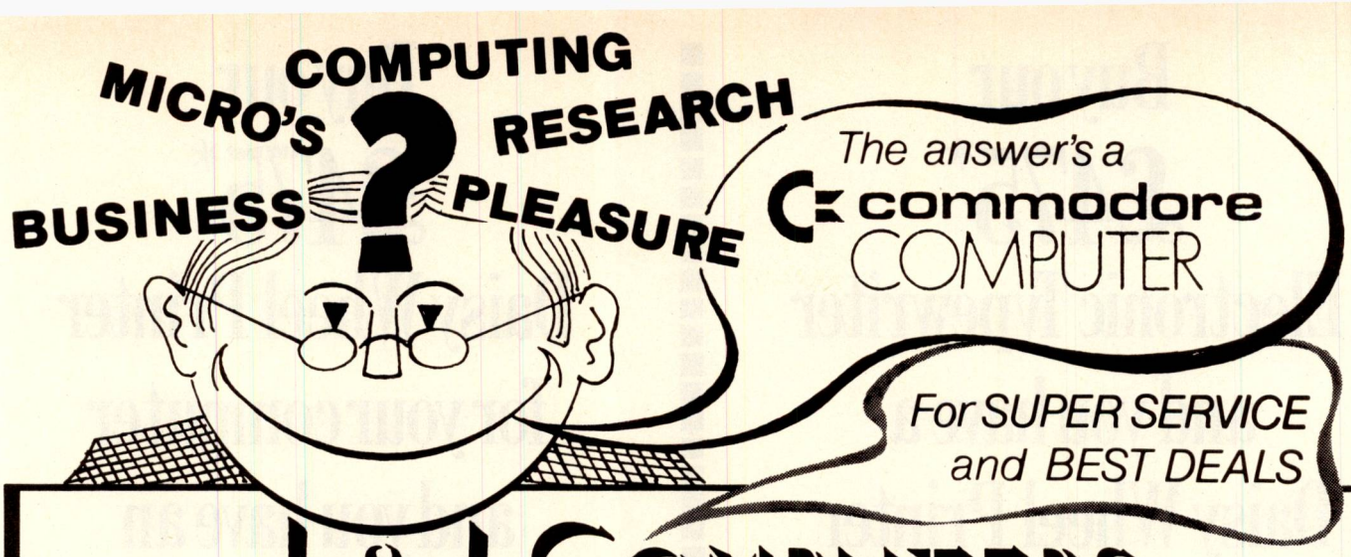
Both programs are disk based requiring the 1540, 4040, or 8050 disk drives.

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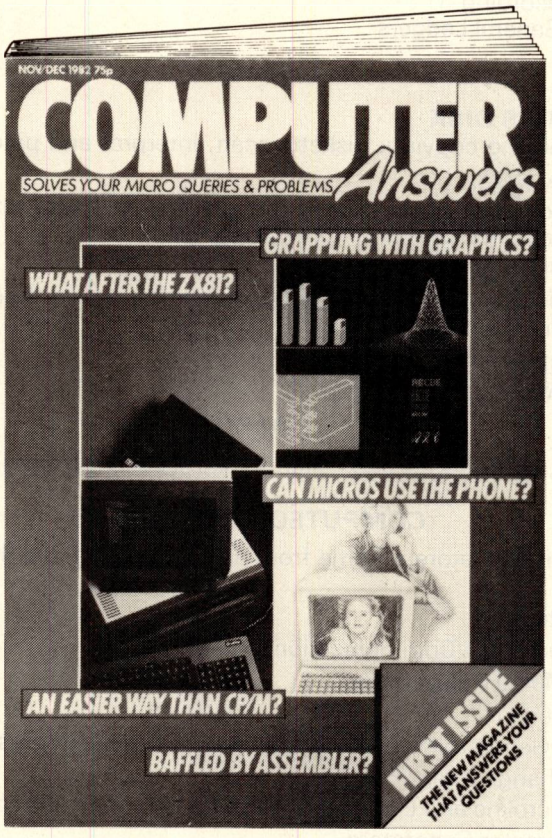
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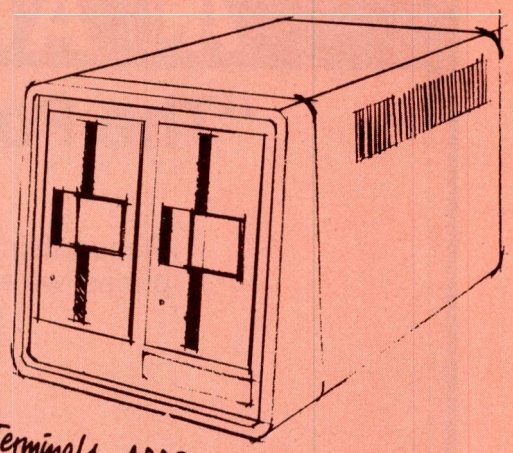
MEMO
From the Chairmans Office

TO. Wes Powers.

Your design for the McCombo is a winner! Can you let me know what peripherals it will connect to. Can you assure me that it's easy to build up a system based on the McCombo that will suit everyone. Small businessman, office manager, educationalist etc. Remember the McCombo concept is to let the customer choose peripherals that suit his need, building up the system that he needs.

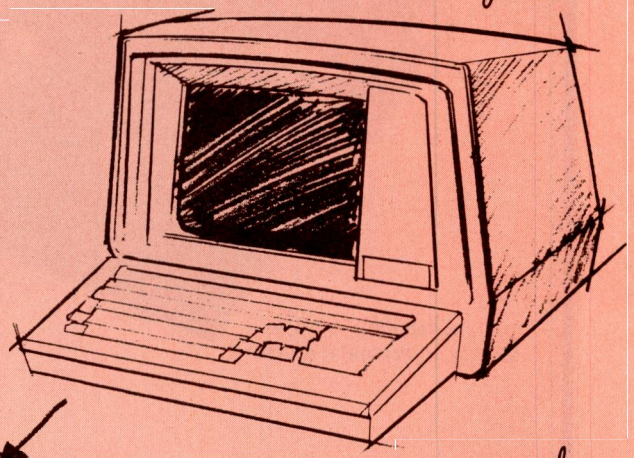
J.J.

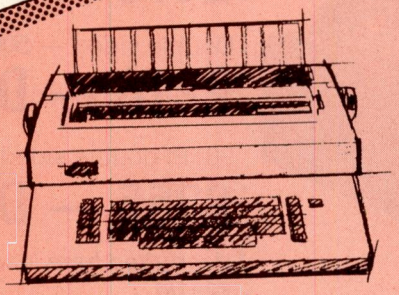
With the hard disc option you get all the storage you need for mailing lists etc.



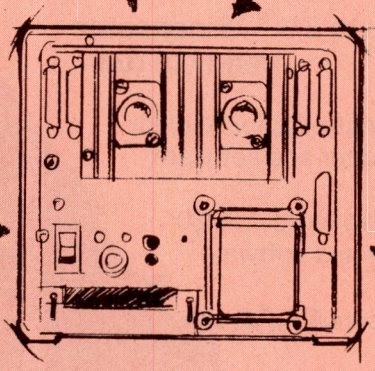
Costs around £1,000

OK Terminals. ADDS, DEC, Hazeltine, Kimtron, Lear Siegler, Televideo, Newbury, Lime etc etc, they're all compatible. The automatic baud sensing in the McCombo means you just plug them directly into an RS232 and they will work instantly

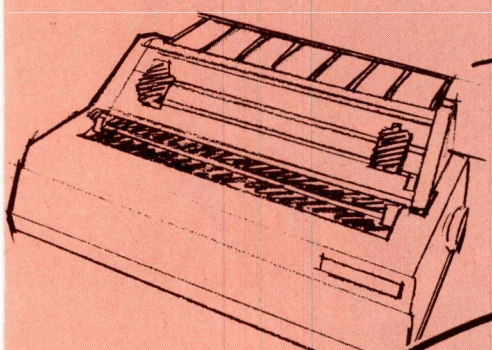


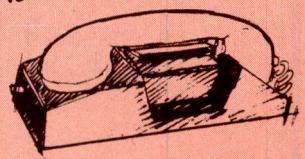


Now. Printers. Anadex, Diablo, Epson, NEC, Okidata etc. etc. They're all centronics or RS232 based. Just plug 'em in. In fact the McCombo can easily run a dot-matrix for invoices etc and a daisy-wheel for word processing. The McCombo will link up with the latest electronic typewriters. Olivetti, Facit, Silver Reed etc for really low cost word processing.

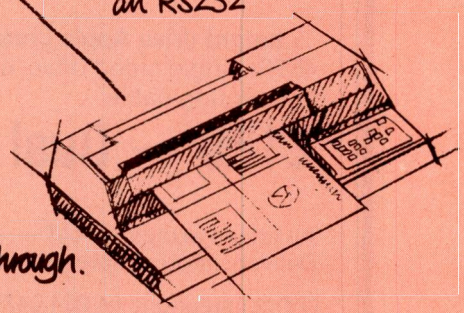


For national and international communications all you need is a British Telecom modem. The McCombo can handle it.





Plotters etc. Again just plug into an RS232



PS. Must remind JJ that a McCombo and teminal can link up to ICL, IBM mainframes etc.

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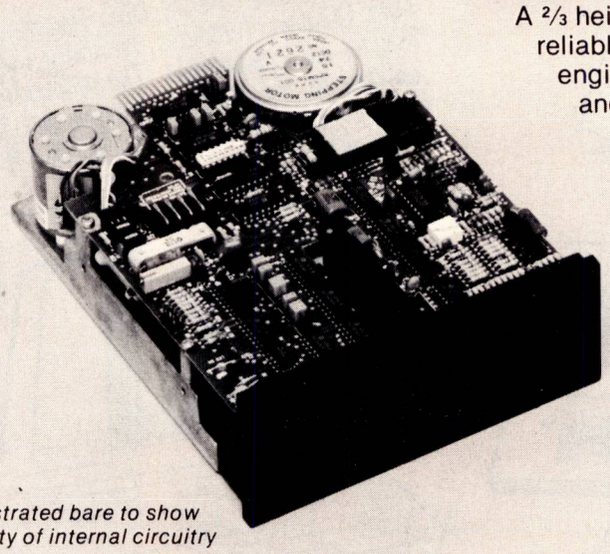
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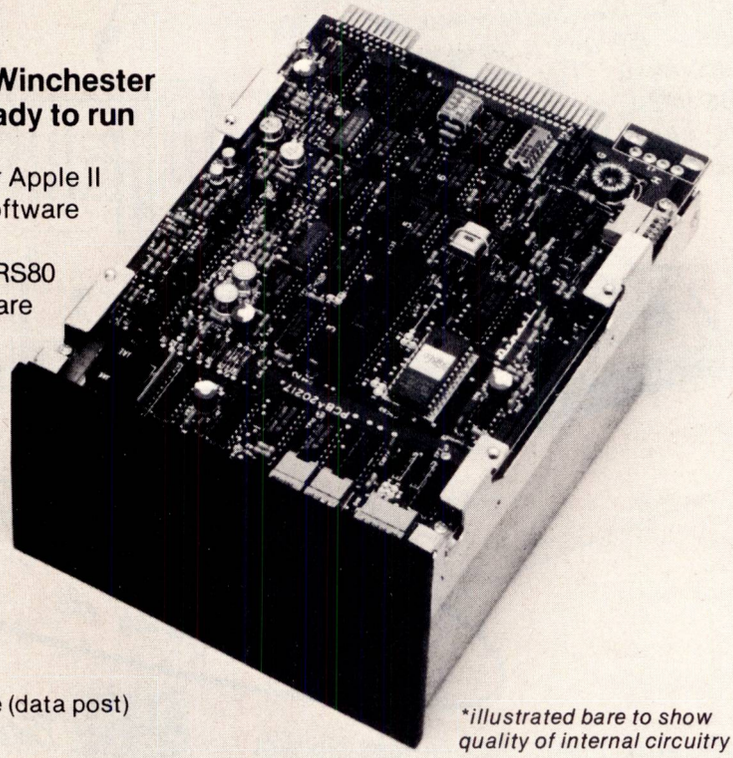
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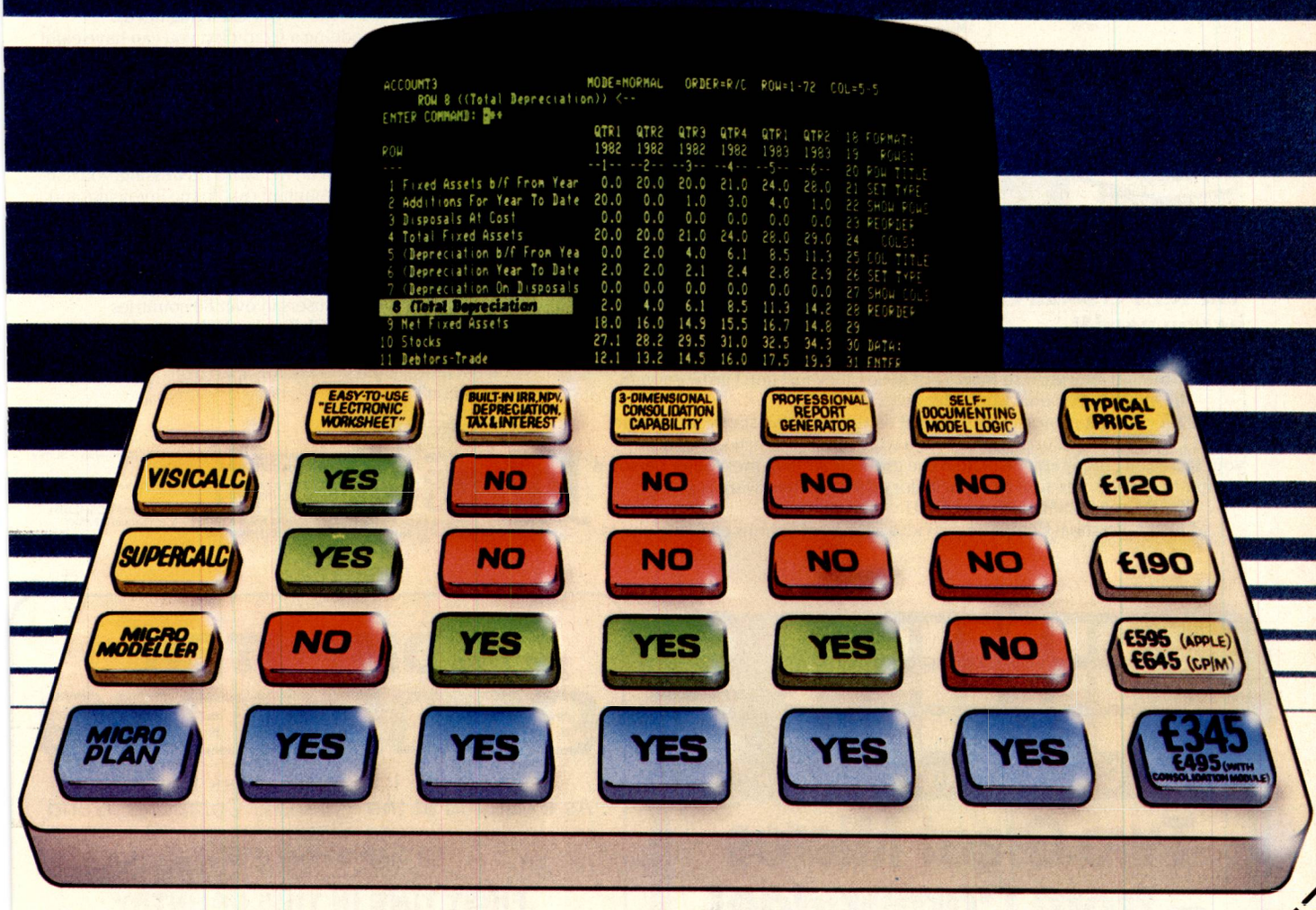
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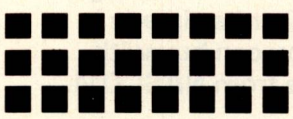
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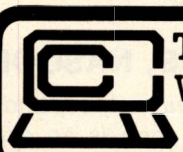
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- Fast access to single pixels.
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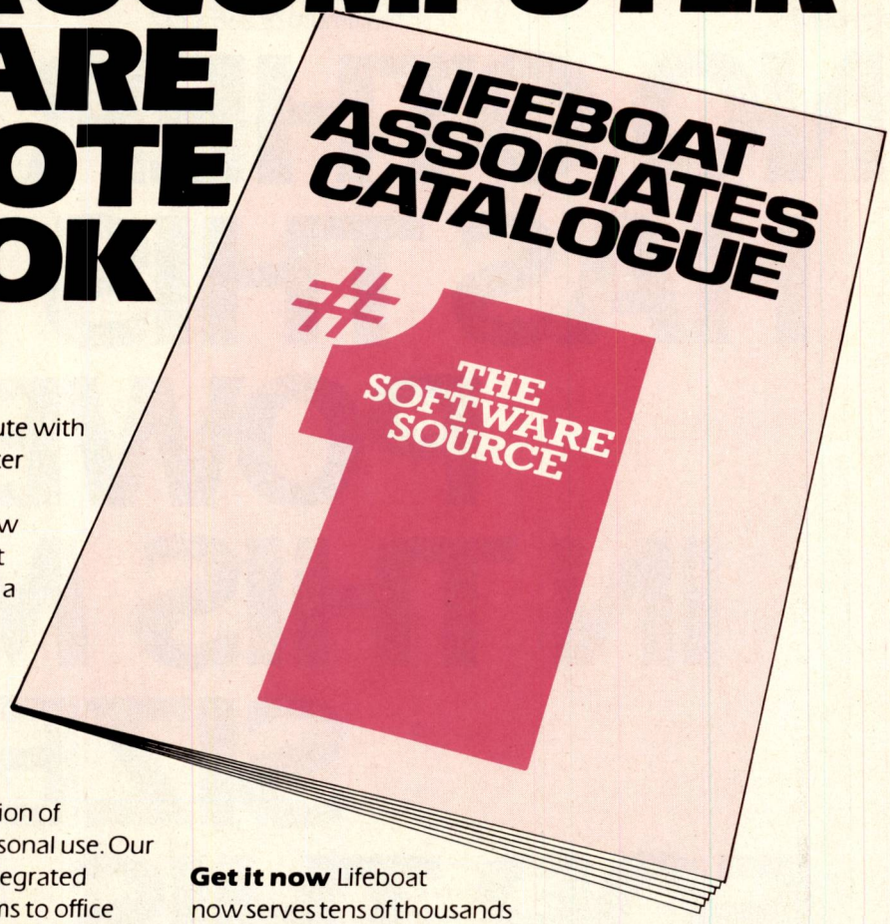
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Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of £269.95 including VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to u this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to your teeth into.

And it'll also take CP/M® so it spea the same language as all the big busine micros, and feels perfectly at home with their software.

# NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.



so as a business machine it really
mes into its own.

The video allows 40 or 80 characters
r line with 25 or 30 lines per page,
ving a very professional 2000 or 2400
aracters display in all on TV and/or
nitor. And the keyboard is full-sized so
en if you're all fingers and thumbs you'll
l be able to get to grips with NewBrain's
cellent editing capabilities.

When it comes to business graphics,
ngs couldn't be easier. With software
pabilities that can handle graphs, charts
d computer drawings you'll soon be
to things that used to be strictly for the
league.

**Answers a growing need.**

Although NewBrain, with its optional
board display, is a truly portable micro,
t doesn't stop it becoming the basis of a
y powerful system.

The Store Expansion Modules come
ackages containing 64K, 128K, 256K
512K of RAM. So, hook up four of
512K modules to your machine and
u've got 2 Mbytes to play with. Another
ture that'll come as a surprise are the
onboard V24 interfaces.

With the aid of the multiple
4 module this allows you to run up to 32
chines at once, all on the same
ripherals, saving you a fortune on extras.

The range of peripherals on offer
lude dot matrix and daisy wheel printers,
12" and 24" monitors plus 5¼" floppy
k drives (100 Kbytes and 1 Mbyte) and
" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

**It doesn't stop here.**

Here are a couple of extras that
serve a special mention.

The first, the Battery Module, means
u won't be tied to a 13 amp socket. And,
en more importantly, it means you don't
ve to worry about mains fluctuations
eaking havoc with your programs.

The ROM buffer module gives you a
edom of another sort.

Freedom to expand in a big way. It
es you additional ROM slots, for system
tware upgrades such as the Z80
sembler and COMAL, 2 additional V24
ts, analogue ports and parallel ports.

From now on the sky's the limit.

**Software that's hard to beat.**

A lot of features you'd expect to find
software are actually built into
wBrain so you don't need to worry about
een editing, maths, BASIC and graphics.

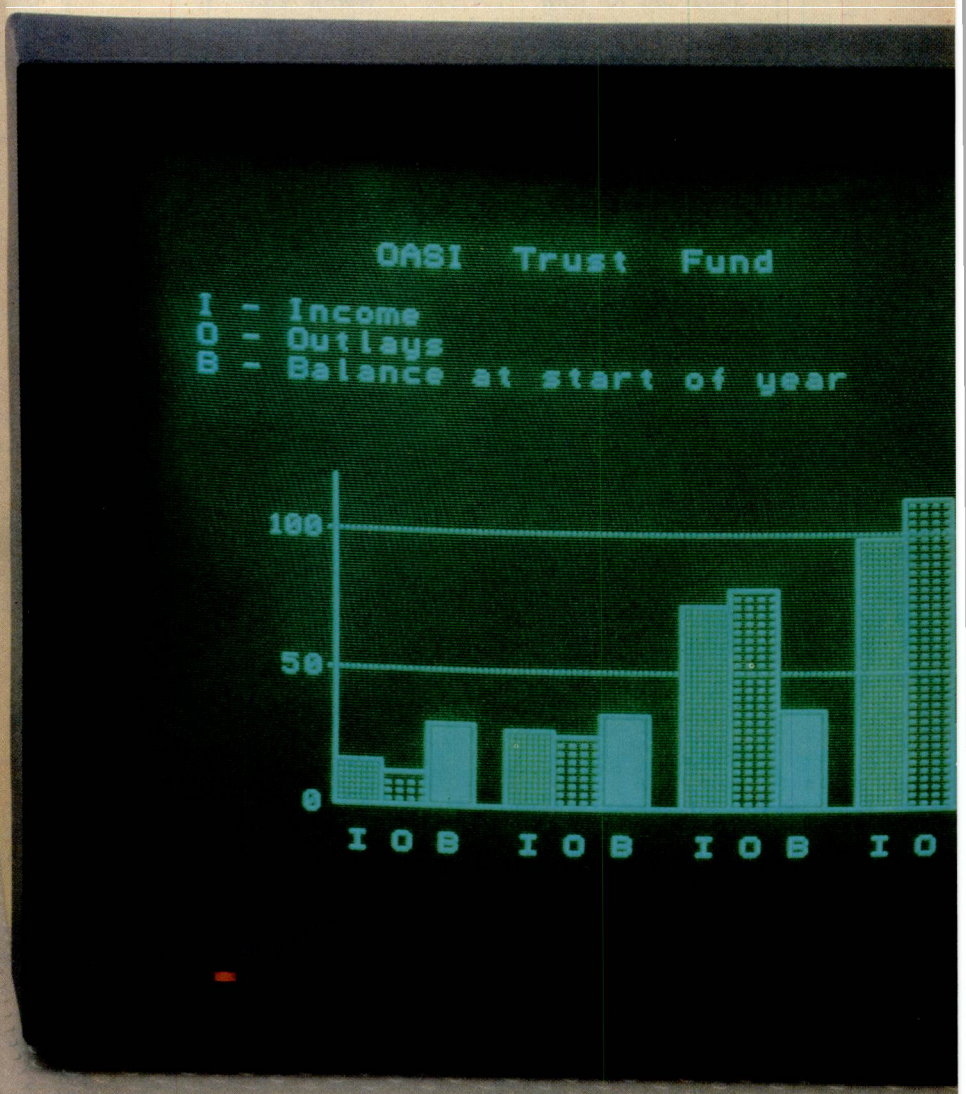
However, if you're feeling practical
u can always tackle household manage-
nt, statistics and educational packages.
d because NewBrain isn't all work and
play, there's the usual range of mind-
nding games to while away spare time.

**Waste no more time.**

To get hold of NewBrain you need go
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start, and a list of peripherals, expansion
dules, and software so you'll know
ere to go next.

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**Technical Specifications**

The NewBrain is a fully specified professional computer built to the highest standards of engineering and reliability. Chosen by leading OEM suppliers. Designed to facilitate easy expansion for use with the CP/M operating system, and the addition of 5¼ flexible and Winchester disks, 12 green phosphor professional standard monitor, 80 cps professional quality dot matrix printer with pin addressable graphics.

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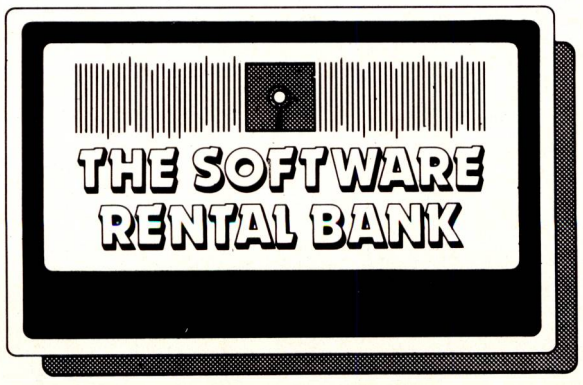
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You are in a single fighter plane as the sole survivor of a space fighter squadron, whose mission it is to invade enemy defences and to destroy their neutron bomb cache. The mission is highly dangerous and the enemy has installed extremely efficient defences around their neutron bomb stores. These are made up of four defence rings, each with its own special dangers. To get to the neutron bomb store you must penetrate all four. As you knock out defences you are awarded points; 10 for ground missiles, 100 for radar bases, 200 for defending para-troopers and 1000 for the first neutron bomb store. The game supports two players if required.

The game may be customised; a terrain editor is included in the package and in this way, the landscape, number and positions of the missiles and radar bases can be changed by the user. Excellent graphics and, of course, sound. Compatible with all Genies and the Model I and Model III TRS-80.

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## STRIKE FORCE

A fast moving arcade type space game. Full of action and plenty of surprises!

In some ways this is a similar game to Penetrator. We think it is slightly better, but tastes vary. The chief difference is that a ''preview'' of approaching enemy forces is shown at the top of the screen, rather in the same way as our Defend game. The aim of the game is to penetrate defences to obtain access to a neutron bomb. In order to do this you have to collect some incendiary star shells. This is done by way of a rather tricky manoeuvre, whereby one has to manoeuvre one's ship to sit on the star shell, rather like a hen hatching an egg. When the position is just right the star shell attaches itself to your ship.

To play Strike Force you will need skill, cunning, fast responses and a keen sense of strategy. Most people find it more taxing than Penetrator and the ''preview'' of advancing forces is certainly one of the key features of the game. It does, of course, have sound. Both Strike Force and Penetrator are published by Melbourne House, an Australian Company. Strike Force is compatible with all Genies and the Model I and Model III TRS-80.

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# DATA-WRITER

Data-Writer is, for most microcomputers, a new concept in Database Management. It adapts techniques which have been known and used on mainframe computers for quite a long time. A "normal" microcomputer Database Management program constructs its file in a single plane and is probably more accurately described as a file handling system. All of the data written into each record is filed away on disk in the same place, and it is all recalled and acted upon by the computer as one chunk of data.

Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly AJEDIT and Scripsit are supported. If you do not have a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a **Management** program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing, in that if a section of a program (for instance the word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

There are very few restrictions with Data-Writer. The number of records which one can handle in any given database is, essentially, unrestricted although any that span disks would have to have different names. In any event as the Sort section of the program does have a restriction of sorting 4,500 records at a time, this effectively imposes a restriction on the length of the file if one intends to be able to sort it all at one time. The maximum number of fields permitted to a record is 20 and the maximum number of characters per field depends on whether you use the Entry section of Data-Writer to enter your data or whether you use a word processor. In the latter case the maximum number of characters per field is 240. In the former it is 35. The maximum number of characters per field label or title is 20.

Data-Writer has a very powerful mathematical section whereby many complex mathematical functions can be carried out on your data. Up to 20 equations may be defined per run. The section will have available 10 scratch pad memories for use and as the calculations are carried out in double precision they will be carried to 16 decimal places.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be of any length up to 6,000 characters, which we believe is about two and a half A4 sheets.

The Sort is a two level one and supports the extraction of stipulated data from a field. It is what might be called of fair speed. The two key levels make it powerful but as the Select section is so good, the Sort does not get used as often as would be the case in other Databases.

Data-Writer is made up of 10 sections or sub-programs as follows:

| | | | | |
|---|---|---|---|---|
| Entry | Manage | Maths | Sort | Letters |
| Edit | Statistics | Select | Labels | Reports |

We have aleady mentioned many of them, others such as Edit are self-explanatory. The Labels section enables you to create pretty well any form of label required, including the ability to have them printed up in a from one to four across format. The Letters section enables you to create a form letter in Data-Writer if you do not wish to use an external word processor. Statistics is a method for searching the database for errors, and as the title suggests, extracting essential statistics from it.

The important sections not yet touched upon are Manage and Select. Taking the latter first, this section enables you to create a sub-set of the database by selecting from the file contents. It is immensely powerful and supports nine equivalency relationships, such as "less than" or "greater than" etc. Furthermore, the two logical relationships AND and OR may be used freely. In this way one can Select from the database to pretty well any specification required. The Management section of the program enables the user to completely re-structure his database without having to Edit it manually. New fields may be added or old ones deleted. They may be re-arranged or even appended one field to another. Indeed, this can be taken even further in that the whole database may be merged or split as required.

The Reports section enables the user to write reports such as inventories, accounts, bibliographies, insurance coverage report, in fact an endless list of applications. Because the Report section contains its own Text Editor, the report contents and format can be controlled at will and literally an infinite number of formats may be adapted.

Data-Writer is one of the most powerful Database Management systems that we have seen available for a microcomputer and certainly is the most powerful that we have seen for the TRS-80 and Video Genie machines. Once the database has been manufactured, either by Data-Writer or a word processor, one has complete and utter control over it and the ability to manipulate any part of it; not only the ones mentioned above, but many others which we have not had the space to list. Data-Writer is compatible with the Model I and Model III Tandy machine, the original Video Genie, together with the Genie I and II. A version for the Model III Genie will be available shortly.

Data-Writer is Compiled Basic, hence its DOS compatibility is dependent upon the compatibility of the Microsoft Compiler. Due to Microsoft's disinterest in supporting any other DOS apart from TRSDOS and the non availability of a Tandy Model III Compiler, we recommend customers to use Data-Writer with TRSDOS or LDOS on the Model I and the proprietary DOS supplied on Data-Writer for the Model III. Other DOS's may well be compatible after patching and as we have said the criteria is whether they are compatible with the Microsoft Compiler.

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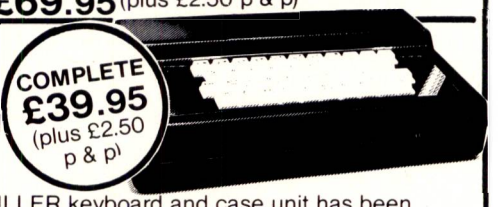
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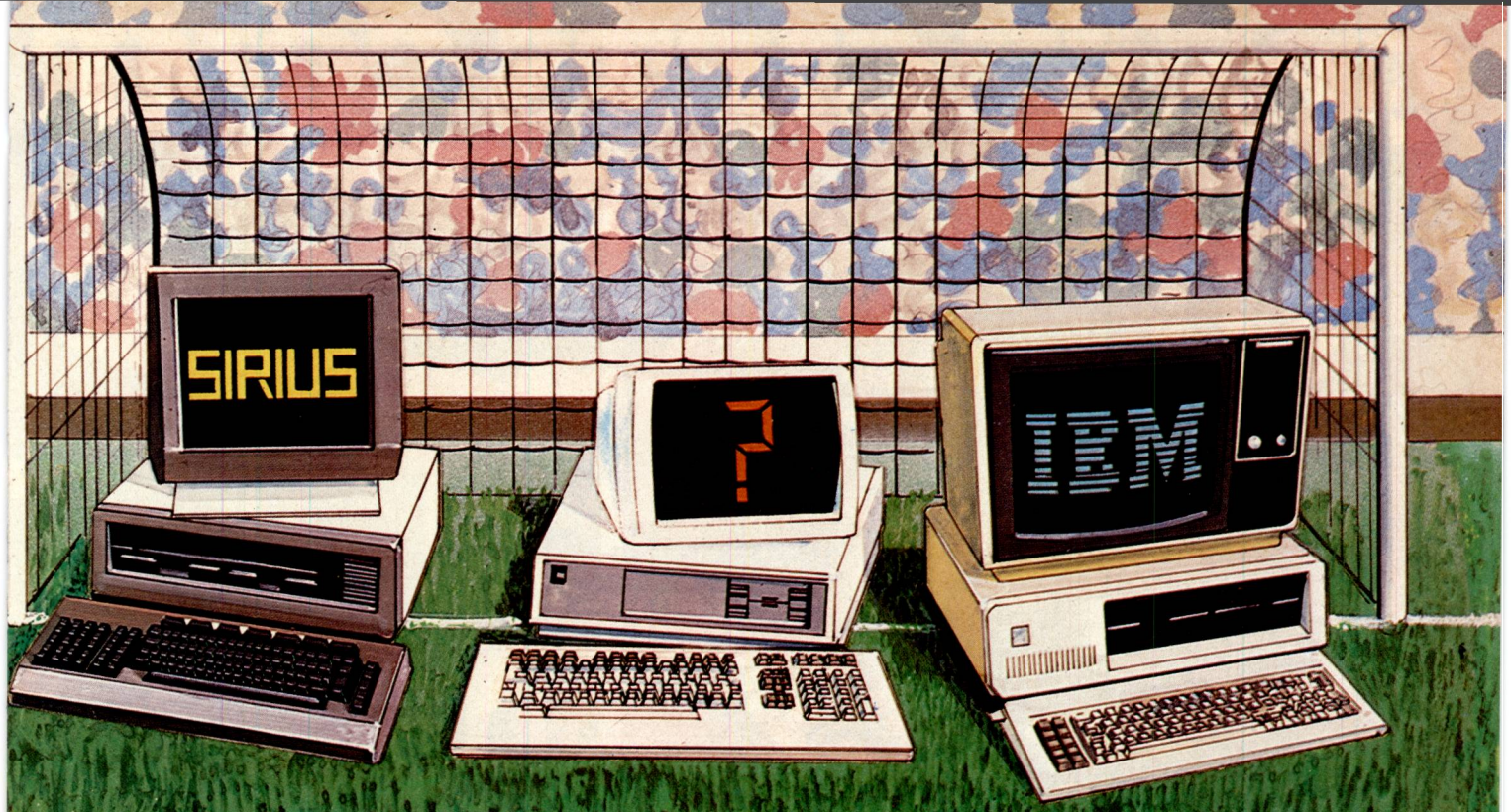
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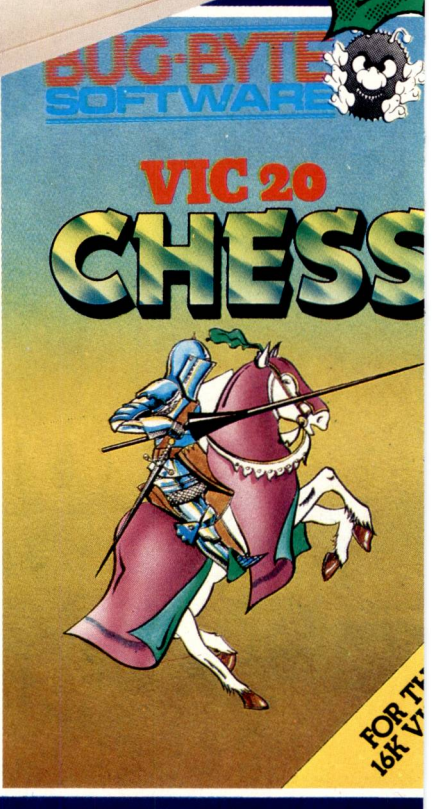


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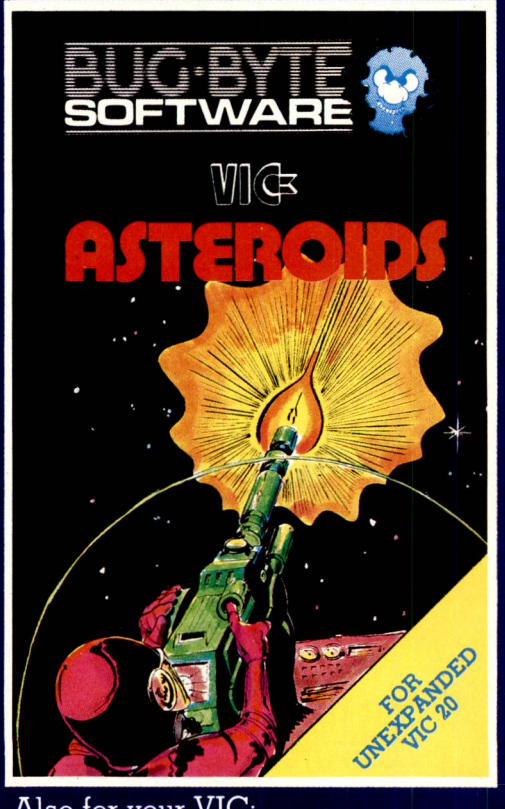


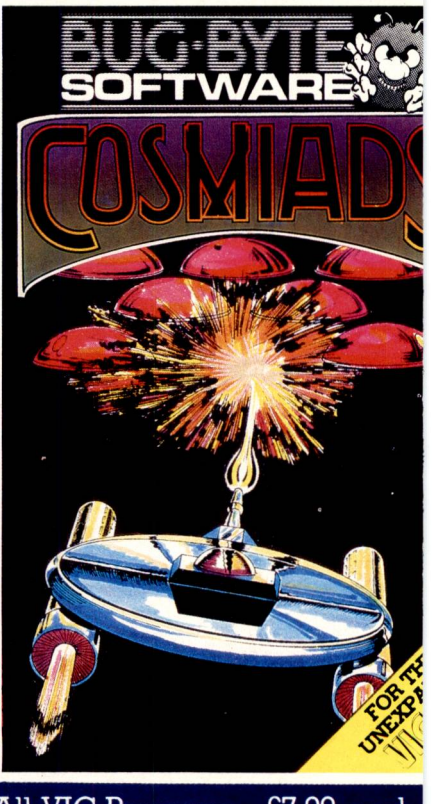

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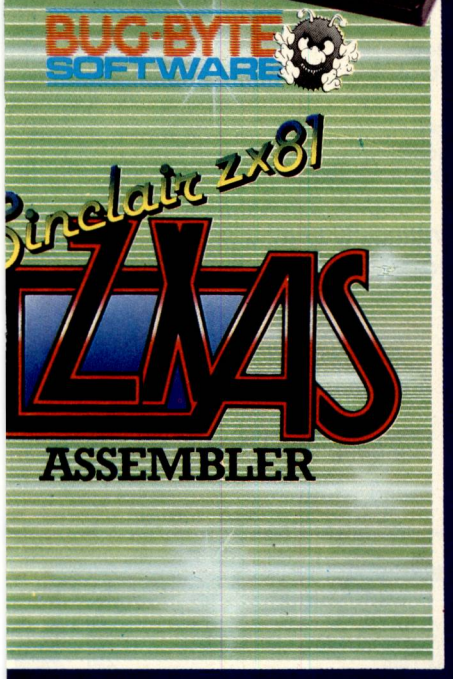

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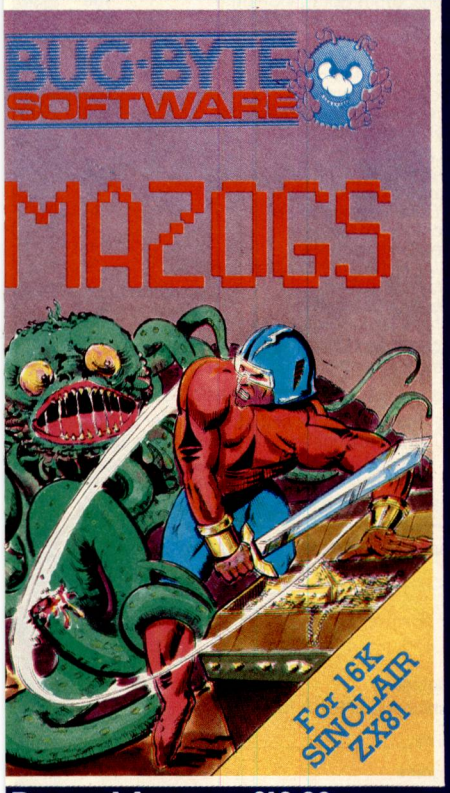




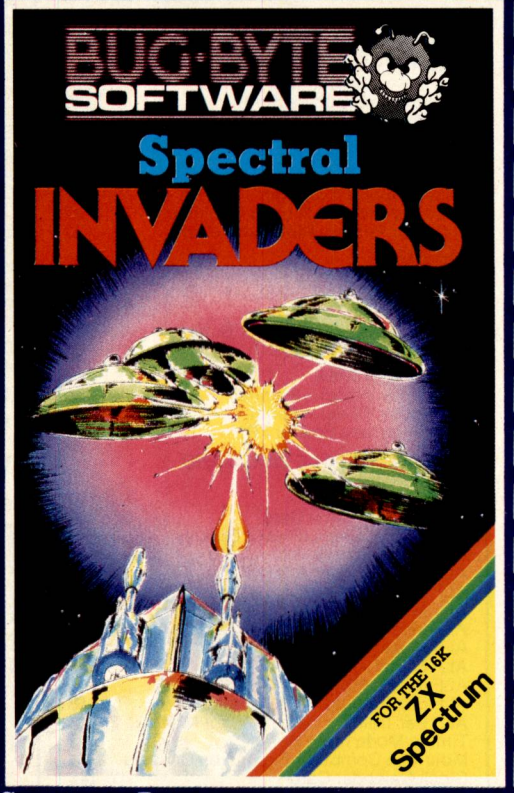
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| Omnivision 80-col Display Card | 168 |
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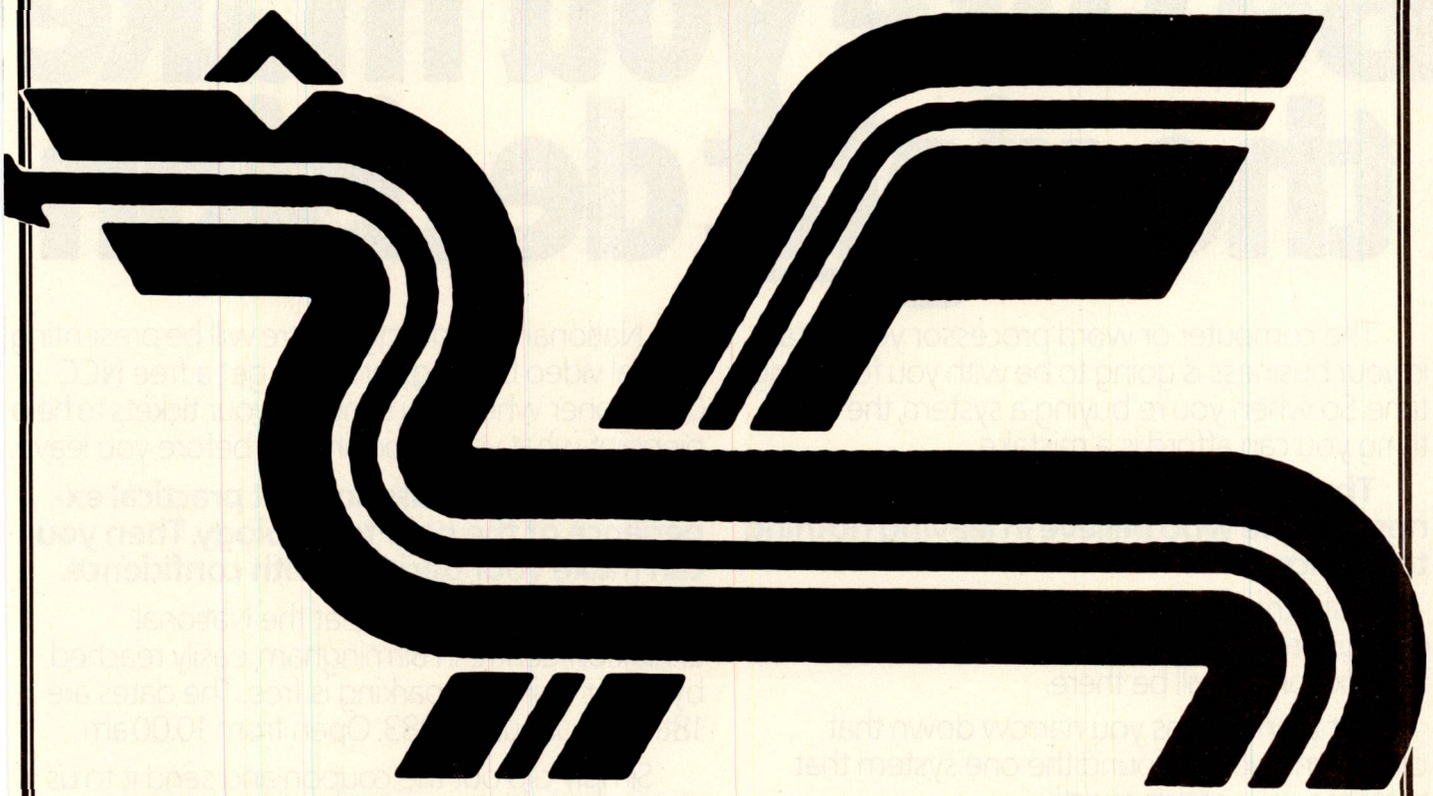
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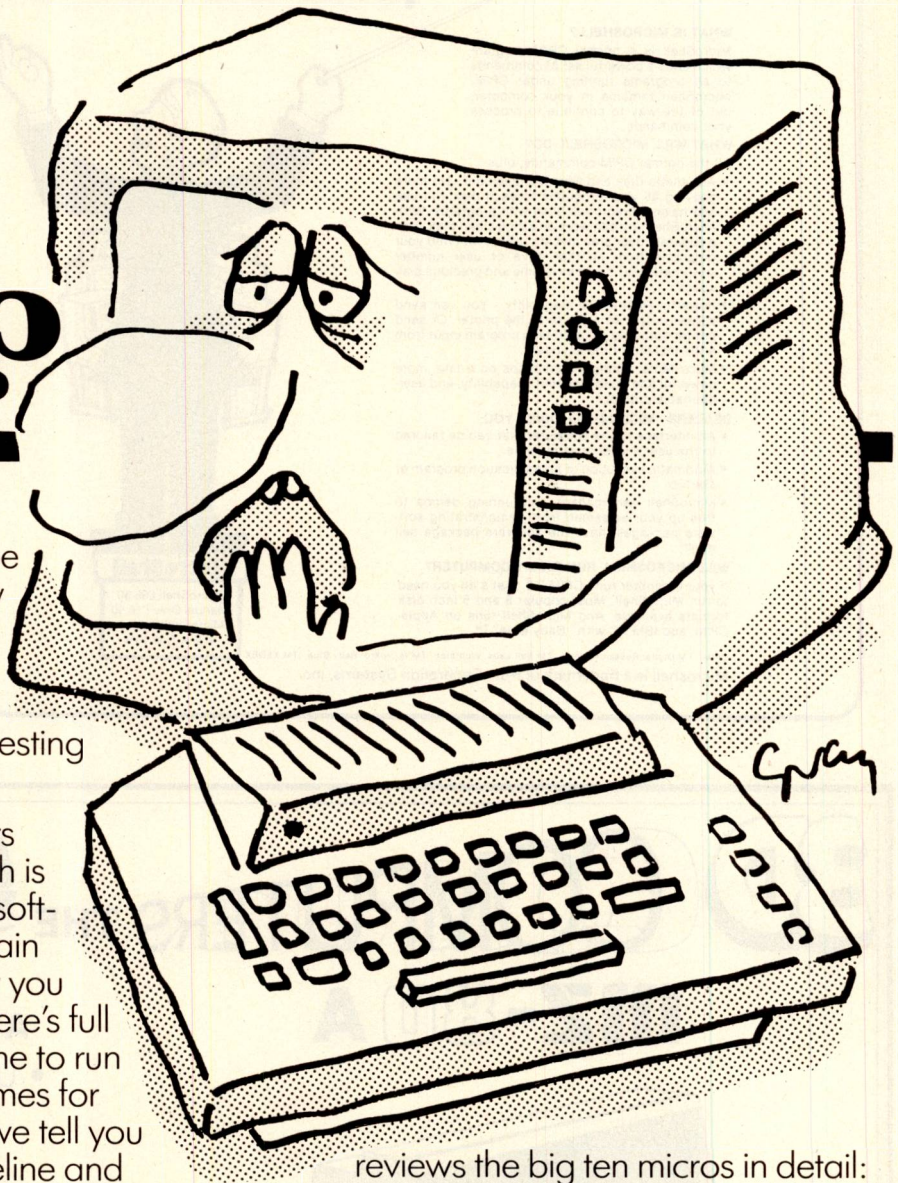
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# GETTING THE MOST FROM YOUR MICRO?



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As well as our unique buyers guide to software packages (which is updated every month) we review software in depth. This month we explain how tele-software works and how you can use it with your equipment. There's full details of the new 'Adventure' game to run on Commodore plus two new games for Ataris and Sinclairs. Every month we tell you what's available, what's in the pipeline and what's right for you—over a range of software for home, business and school users.

We don't stint on hardware coverage either. Not only do we publish the most extensive buyers guide available (over 100 micros in detail) but we also publish reviews that really take machines apart. This month we run a giant test of the Lynx vs the Genie, and there's a 20 page pull-out supplement which reviews the big ten micros in detail: ZX81, Spectrum, BBC A and B, Dragon, VIC, Atari 400 and 800, TI 994A, and the Atom.




Starting this month we're serialising the very funny book "Computer Bluff" which no-one else will be able to read until March next year.

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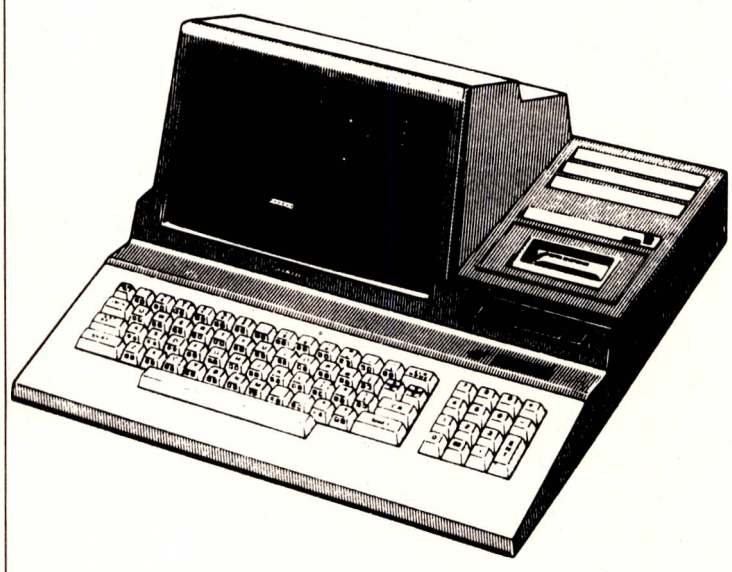
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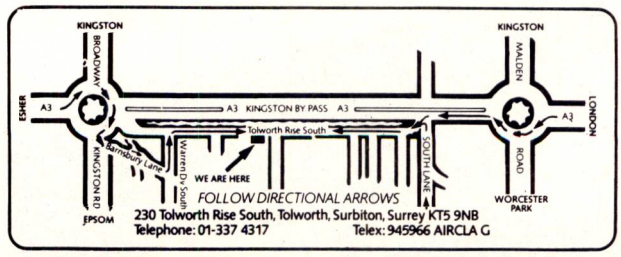
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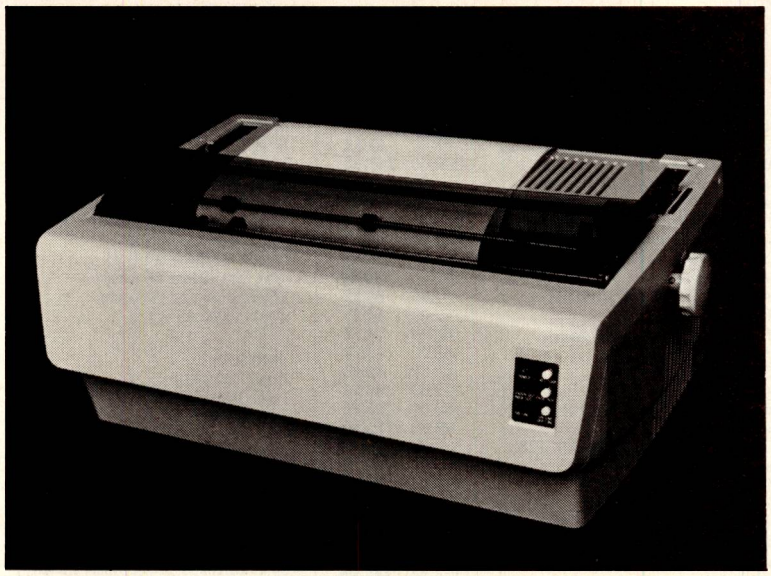



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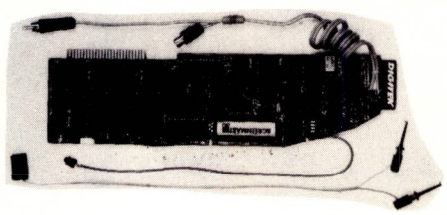
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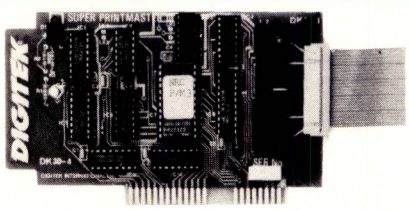
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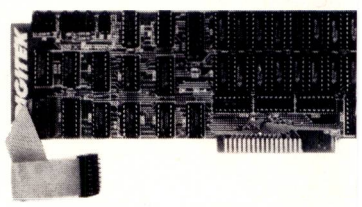
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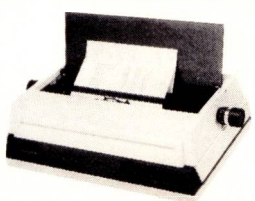

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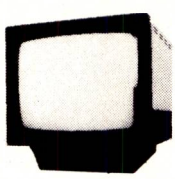

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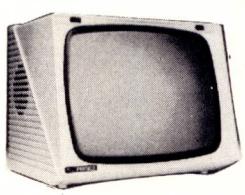
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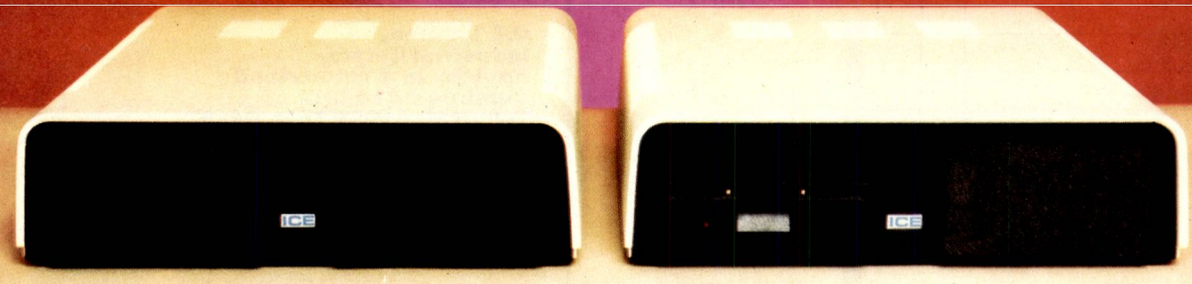



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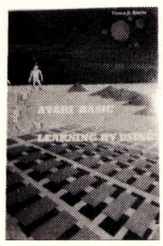
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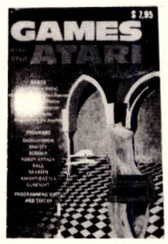
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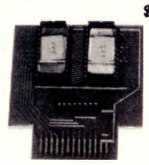
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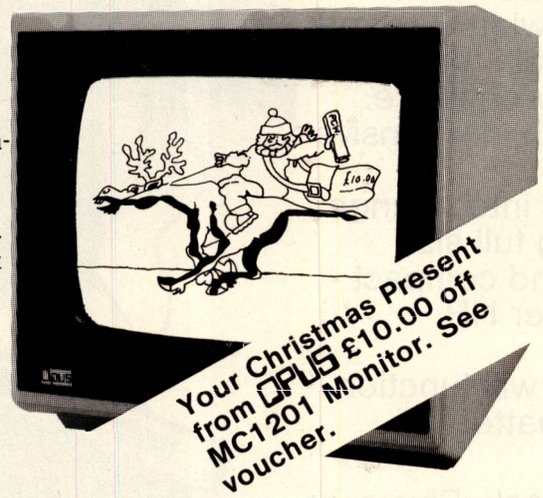
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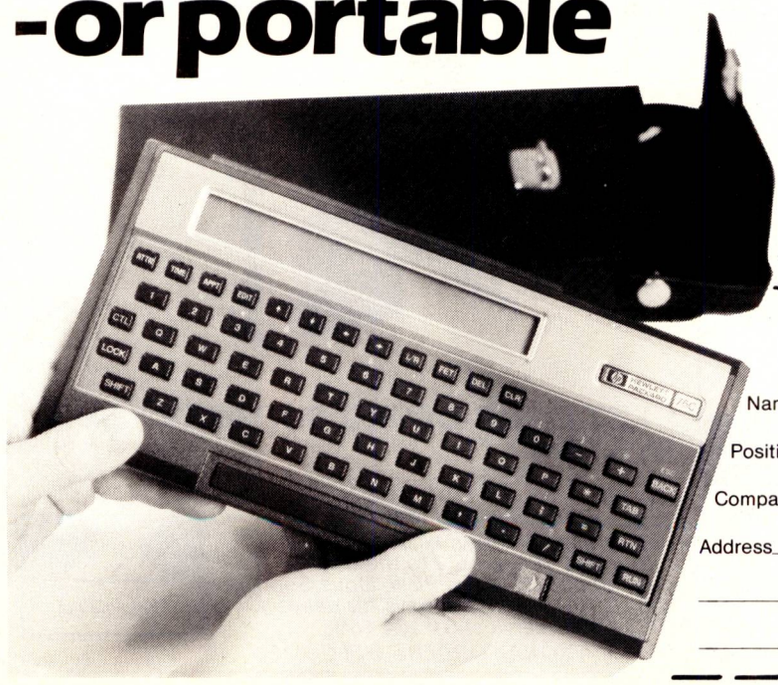
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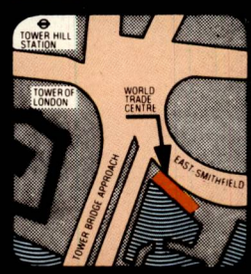
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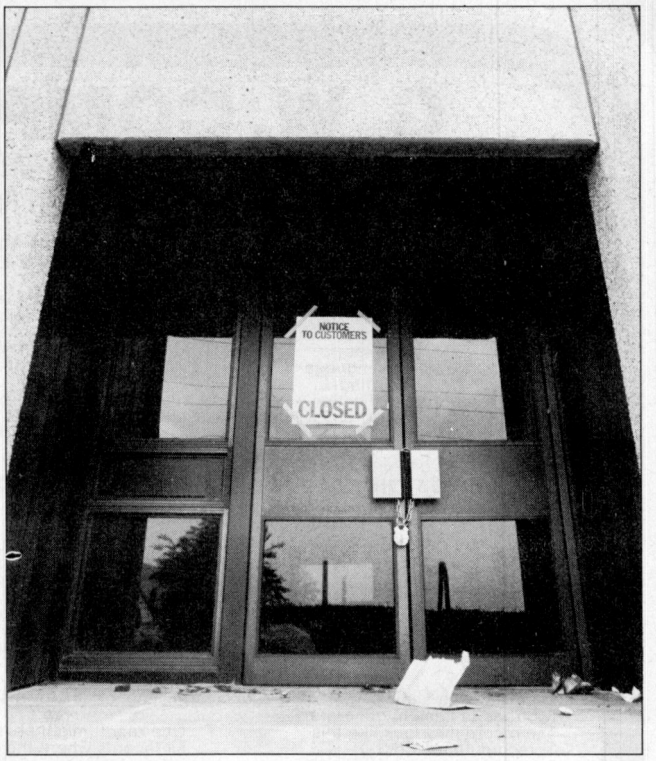
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Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "sale-mail-shots"; "production-process-analysis" "patient history analysis"; "reseach-analysis" "budgetting" "purchase/sales-analysis"; "personnell-file-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Last issue we showed an example of 'short-listing' of employees for a prospective job. Here is an example of a garage stock file and two reports it might generate.
The record may look like this
1- record number (23 )
2- part number (fiat grill 109)
3- location (bin 44 )
4- cost price (29.00 )
5- selling price (38.00 )
6- minimum stock (5 )
7- maximum stock (12 )
8- current stock (3 )
9- manufacturer (Fiat motor company)
10- on order (qty) (<9>)

One report might be: select??
all records where the current stock is lower than the minimum stock
When found, subtract current form maximum, and produce a printed list of the manufacturers name; part number; and re-order quantity
Update the record in field 10 with the quantity ordered.

Another report might be: select??
all records in the file; calculate the values of current stock multiplied by cost price for each record. Add the values together for every record at location London or Glasgow or Leeds and print a list of all such records showing stock values 'individual' and for the specific locations

(next issue's example sale ledger)

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| ACT | – SIRIUS 1 | 128K/1.2M | DISKS | £2395.00 |
| VICTOR | – 9000 | 128K/1.2M | DISKS | £2395.00 |
| OSBORNE | – 1 | 64K RAM/200K | DISKS | 1250.00 |
| IBM | – PC | 64K RAM/640K | DISKS | £2695.00 |
| | – PC1 | 330K/640K | DISKS | £2995.00 |
| ATARI | 400/800 | 16K RAM | | call 00 |
| EPSON | HX/20 | HAND-HELD COMPUTER | | call 00 |
| PET | 8032 | 32K RAM | | 695.00 |
| | 8050 | 1 MEG | DISKS | 695.00 |
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| APPLE | II | 64K RAM | | 675.00 |
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| | ACS800-10 | 208K/10.5MEG | DISKS | 4995.00 |
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| CORVUS | CONCEPT | 16 BIT PC | | call 00 |
| SANYO | G80 | 64K RAM/320K | DISKS | 1350.00 |
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| DBMS III | .magic wand w/proc | .magic calc | |
| mbasic 80 | .diagnostics | .msort/dsort | |
| recover | .autoload | .instant-basic | |
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**** total value 1480.00 ****

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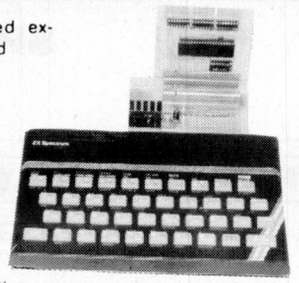
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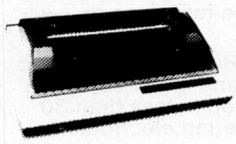


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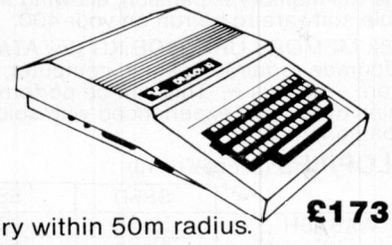
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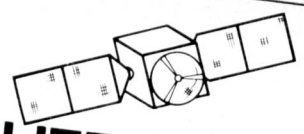
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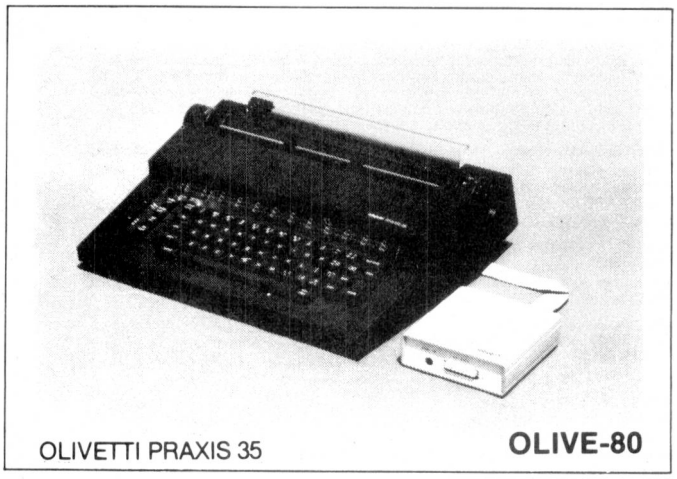
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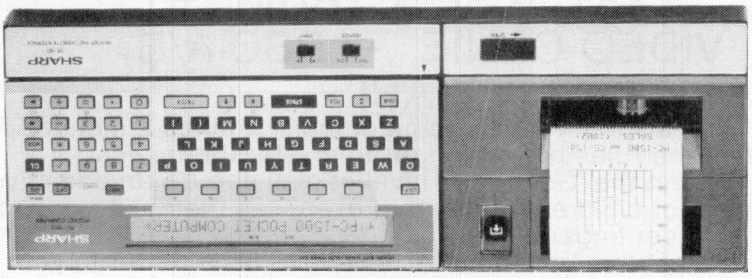
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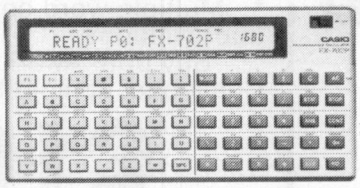
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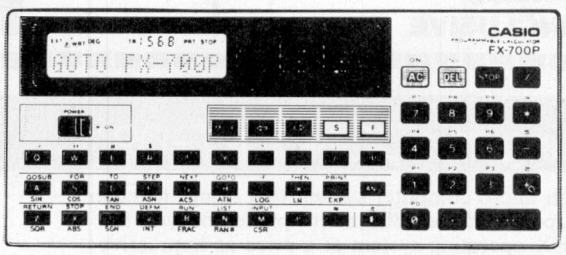
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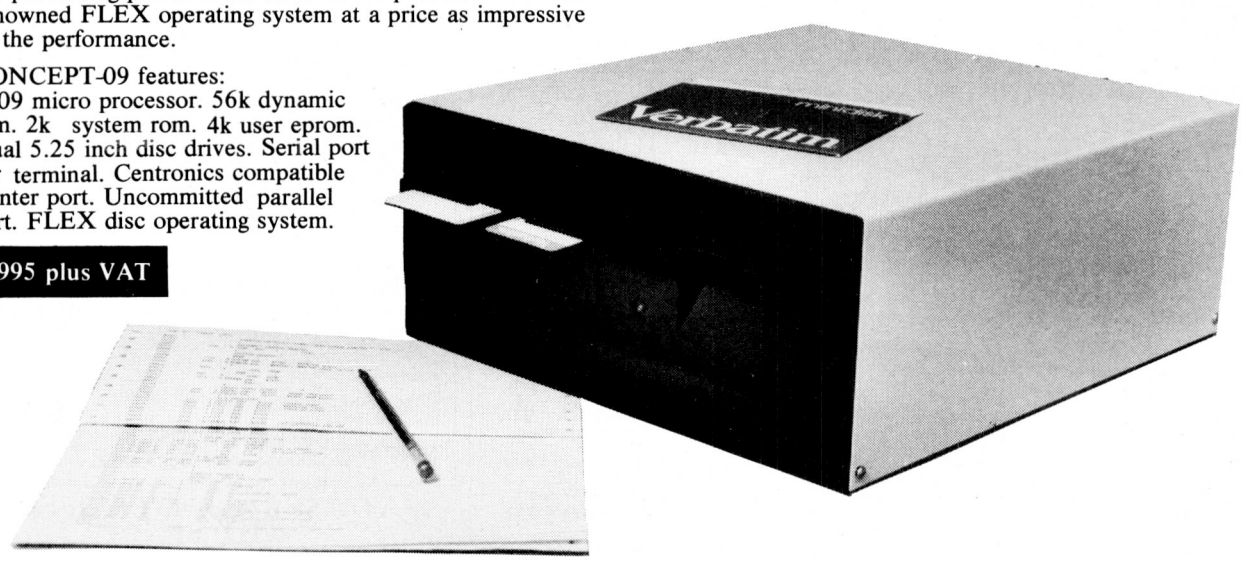
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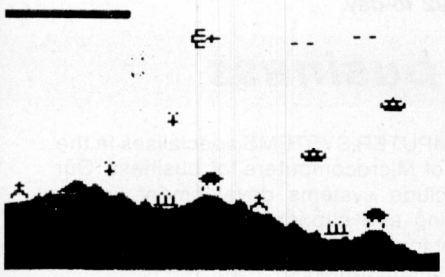
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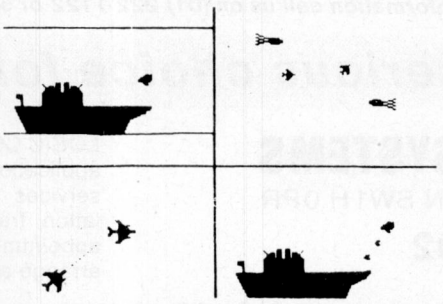
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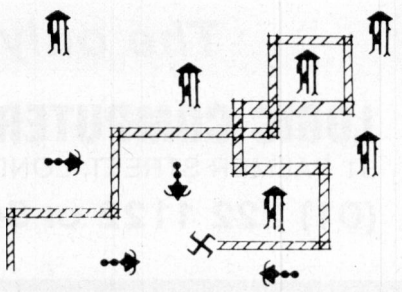
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Points: Ace equals 1 or 11, Jack, Queen, King equal 10.
Scoring 21 points with 2 cards — you automatically win.
Draw — the computer wins.
Your kitty is automatically adjusted win or lose. If you lose all your kitty — game over.
DECIPHER:-
You have to guess what combination of colours the computer has selected — to enter a colour just hit the colour button on the computer when you haveentered your five choices of colour, the computer will display (A) Nothing at all equals None right. (B) Black or White Squares or Both — For every black square you will have a correct colour in the correct position, for every white square you will hjave a correct colour in the wrong position. If you cannot find the complete combination, it will be displayed when you have had twelve attempts.

FOUR THOUGHT:-
You have to make a line of four squares — horizontally, vertically or diagonally BEFORE the computer does, taking turns to take a square (squares can only be placed at the bottom of the grid, or on top of another square). Keys: Hit the number key of the column you want your square dropped in then hit the return key.
TEASER:-
The aim of the game is to score "15" BEFORE the computer does, using any combination of 3 boxes. If you cannot score "15" then you must try and stop the computer from doing so and force a draw. Keys: Hit the number key of the box you want (you can only select an empty box).

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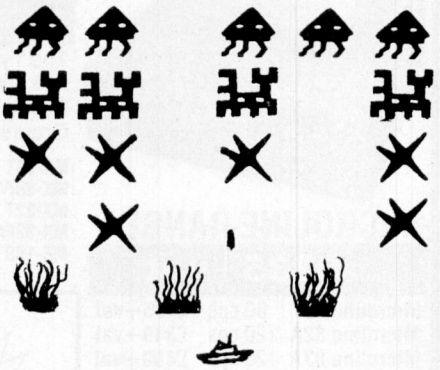
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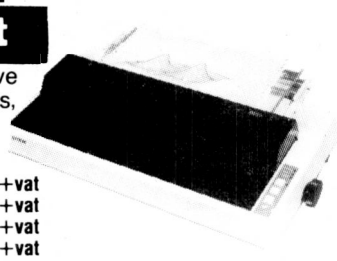
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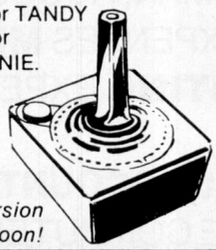
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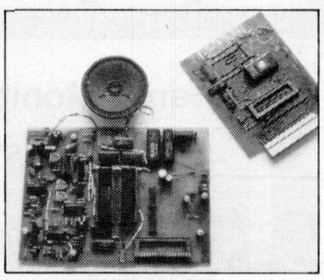
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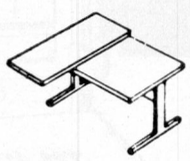
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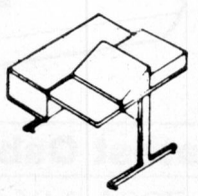
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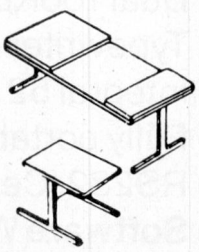
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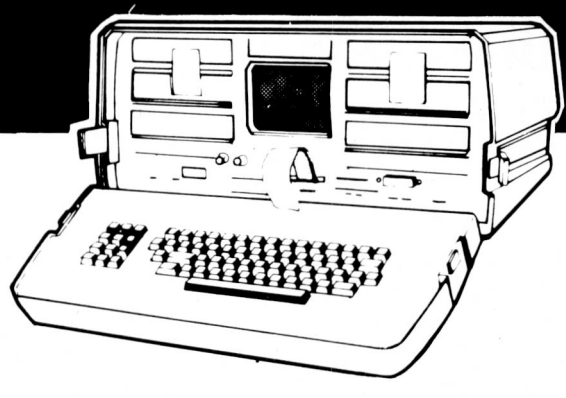
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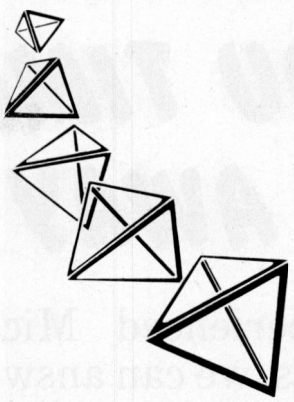
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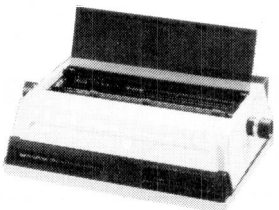
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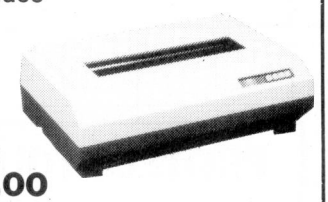
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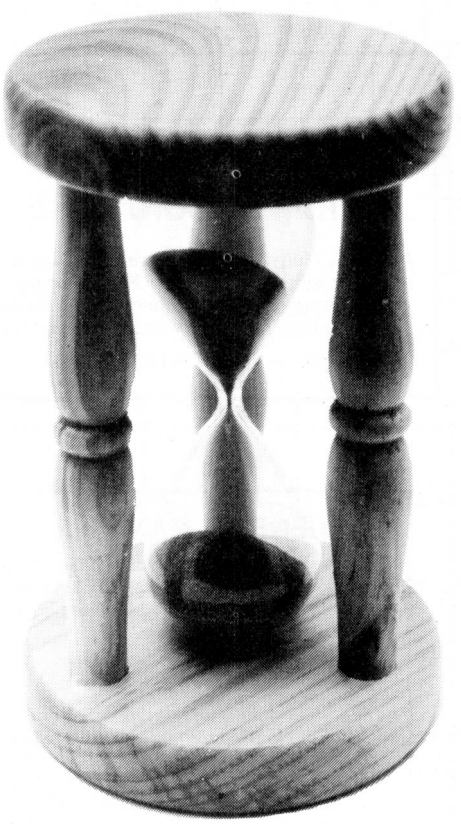
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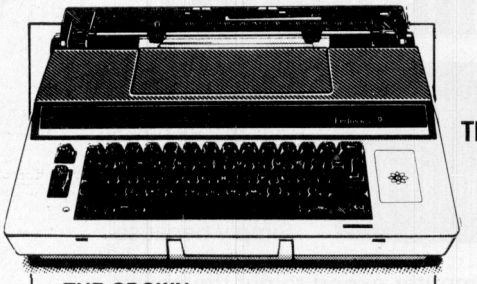
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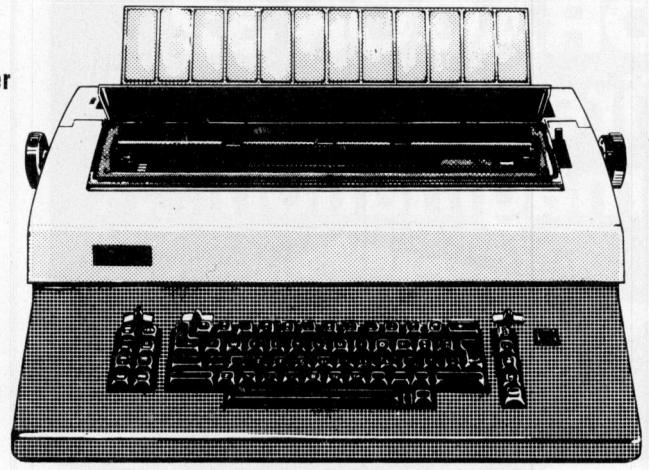


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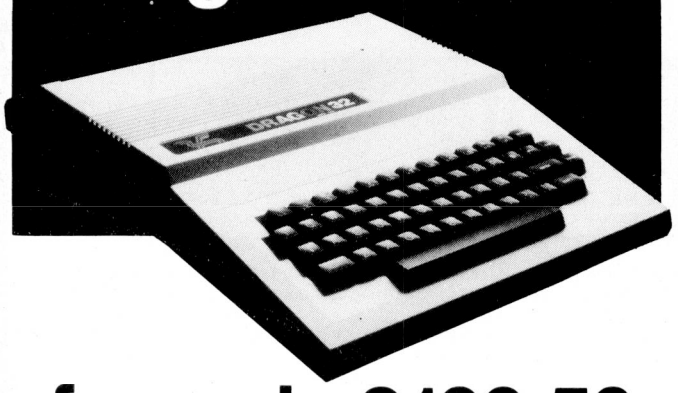
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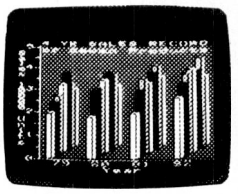
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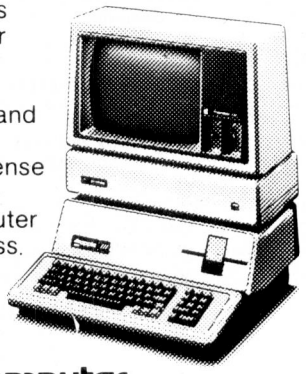


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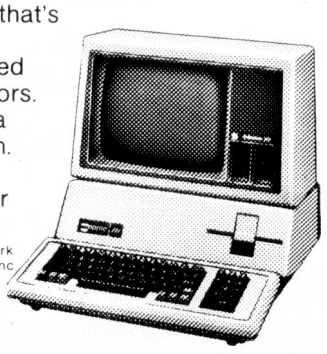
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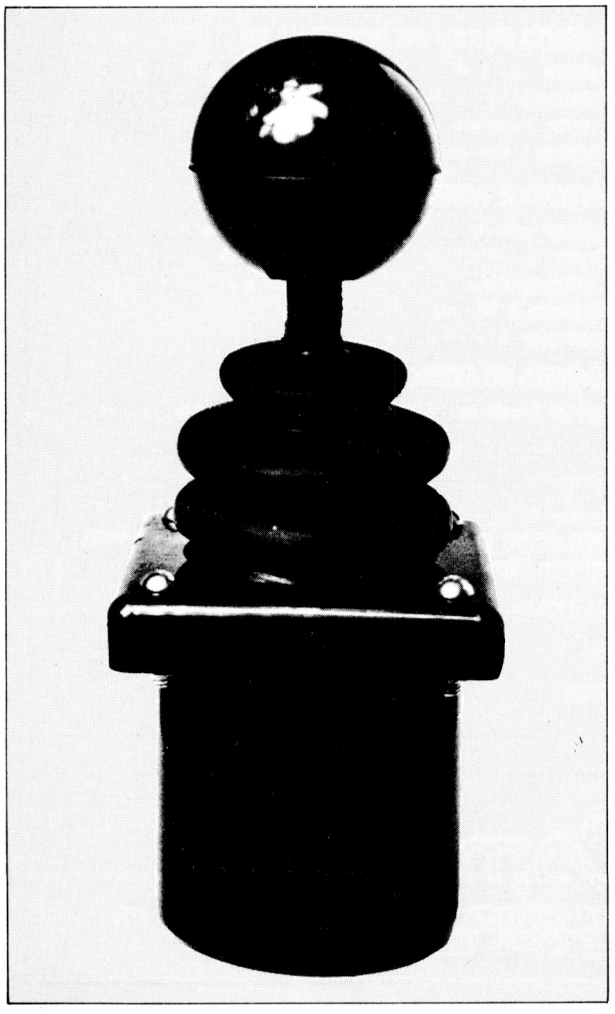
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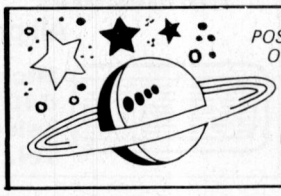
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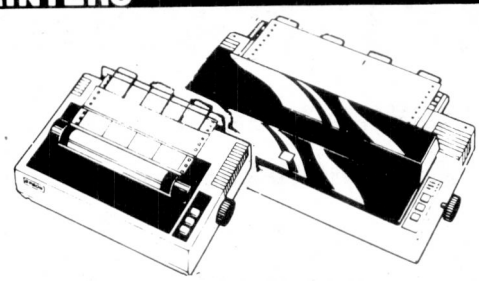
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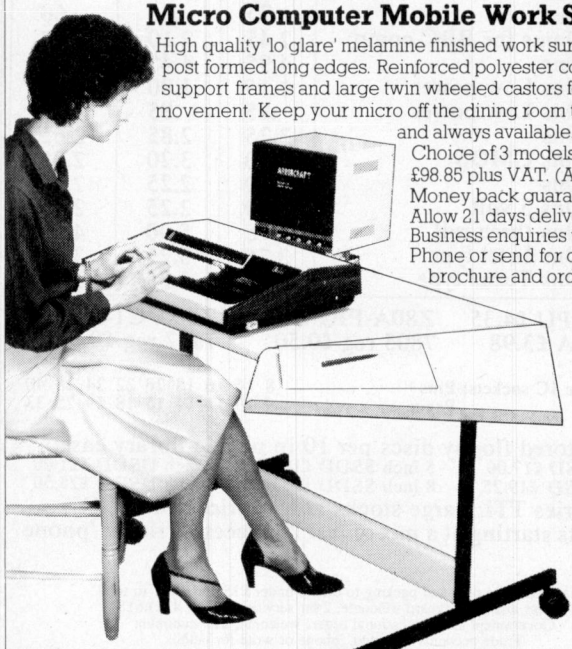
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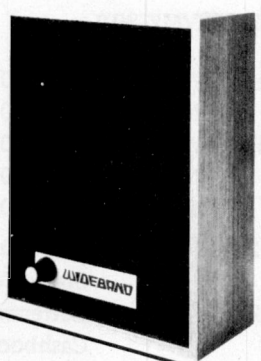
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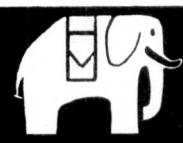
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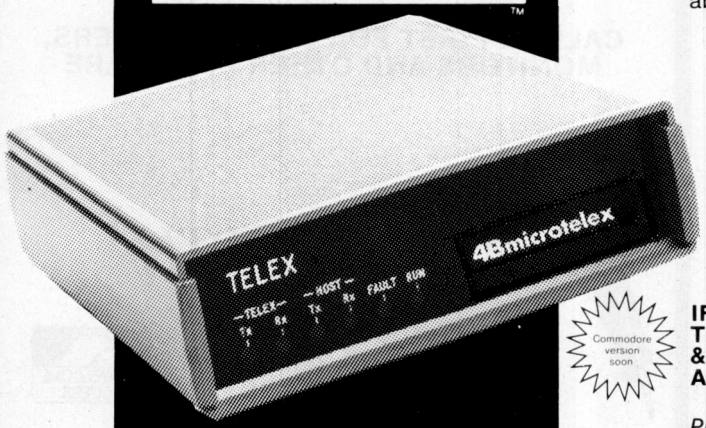
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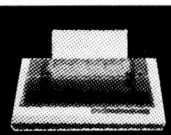
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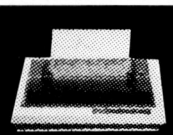
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| 7473 | 24 |
| 7474 | 20 |
| 7475 | 25 |
| 7485 | 60 |
| 7486 | 20 |
| 7489 | 170 |
| 7490 | 20 |
| 7491 | 35 |
| 7492 | 25 |
| 7493 | 25 |
| 74100 | 80 |
| 74116 | 50 |
| 74121 | 25 |
| 74125 | 35 |
| 74126 | 35 |
| 74143 | 210 |
| 74148 | 60 |
| 74150 | 50 |
| 74151 | 40 |
| 74153 | 40 |
| 74154 | 55 |
| 74186 | 470 |
| 74188 | 250 |
| 74383 | 99 |

### 74 LS

| | |
|---|---|
| LS00 | 11 |
| LS02 | 11 |
| LS04 | 12 |
| LS08 | 12 |
| LS10 | 13 |
| LS11 | 13 |
| LS13 | 20 |
| LS14 | 26 |
| LS19 | 58 |
| LS20 | 13 |
| LS22 | 12 |
| LS27 | 12 |
| LS32 | 13 |
| LS30 | 12 |
| LS42 | 28 |
| LS47 | 35 |
| LS48 | 55 |
| LS63 | 120 |
| LS73 | 18 |
| LS74 | 18 |
| LS75 | 20 |
| LS85 | 42 |
| LS86 | 16 |
| LS90 | 24 |
| LS91 | 60 |
| LS92 | 32 |
| LS93 | 23 |
| LS125 | 24 |
| LS126 | 25 |
| LS138 | 25 |
| LS139 | 28 |
| LS148 | 70 |
| LS151 | 40 |
| LS153 | 40 |
| LS156 | 36 |
| LS157 | 27 |
| LS158 | 30 |
| LS175 | 50 |
| LS240 | 55 |
| LS241 | 55 |
| LS242 | 55 |
| LS243 | 55 |
| LS244 | 55 |
| LS245 | 70 |
| LS273 | 54 |
| LS373 | 60 |
| LS374 | 55 |
| LS393 | 42 |
| LS471 | 629 |
| LS640 | 180 |
| LS641 | 180 |
| LS645 | 180 |
| LS668 | 125 |
| LS669 | 120 |
| LS670 | 100 |
| LS673 | 550 |

### CMOS

| | |
|---|---|
| 4000 | 10 |
| 4001 | 10 |
| 4002 | 12 |
| 4007 | 14 |
| 4008 | 32 |
| 4009 | 24 |
| 4010 | 24 |
| 4011 | 10 |
| 4012 | 16 |
| 4013 | 20 |
| 4016 | 20 |
| 4017 | 32 |
| 4018 | 45 |
| 4022 | 40 |
| 4023 | 13 |
| 4024 | 32 |
| 4025 | 13 |
| 4026 | 80 |
| 4027 | 20 |
| 4028 | 39 |
| 4029 | 45 |
| 4030 | 15 |
| 4040 | 40 |
| 4041 | 40 |
| 4042 | 44 |
| 4043 | 40 |
| 4044 | 40 |
| 4049 | 25 |
| 4050 | 25 |
| 4051 | 45 |
| 4052 | 60 |
| 4053 | 50 |
| 4060 | 45 |
| 4066 | 24 |

| | |
|---|---|
| 4068 | 14 |
| 4069 | 13 |
| 4071 | 13 |
| 4072 | 13 |
| 4075 | 13 |
| 4076 | 50 |
| 4077 | 13 |
| 4078 | 15 |
| 4081 | 13 |
| 4082 | 13 |
| 4093 | 20 |
| 4094 | 70 |
| 4095 | 95 |
| 4096 | 70 |
| 4097 | 190 |
| 4098 | 75 |
| 4099 | 75 |
| 4160 | 95 |

| | |
|---|---|
| 4161 | 99 |
| 4162 | 99 |
| 4163 | 99 |
| 4174 | 99 |
| 4175 | 105 |
| 4411 | 690 |
| 4412 | 790 |
| 4502 | 60 |
| 4503 | 35 |
| 4511 | 46 |
| 4519 | 30 |
| 4539 | 90 |
| 4549 | 375 |
| 4572 | 36 |
| 4583 | 99 |
| 4584 | 48 |
| 4585 | 99 |
| 4597 | 330 |

| | |
|---|---|
| 4598 | 290 |
| 4599 | 290 |
| 40100 | 215 |
| 40104 | 95 |
| 40105 | 115 |
| 40106 | 75 |
| 40107 | 60 |
| 40108 | 450 |
| 40109 | 100 |
| 40110 | 300 |
| 40114 | 240 |
| 40163 | 50 |
| 40174 | 45 |
| 40193 | 95 |
| 40244 | 195 |
| 40373 | 240 |
| 40374 | 245 |
| 45106 | 595 |

## DRAGON
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6809E Microprocessor based computer 32K RAM as standard,expandable to 64K. Has nine colours, 5 resolution graphics from 16 x 32 to 256 x 192. Extended Microsoft colour Basic. Advanced graphic commands. 5 octave sound through TV speakers. Full editing-Inert, Delete, Amend. QWERTY keyboard. Simple plug-in type connections for Joysticks, cartridges & cassette. Centronic printer port. 160 page 'BASIC' manual.
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**NEW CONCEPT**

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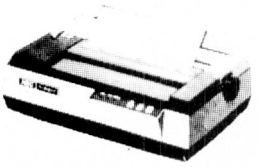
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Europe's most popular Printer

## NEC PC8023-C



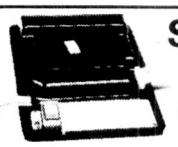
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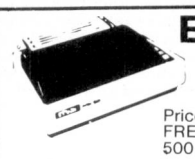
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| 2732 | 350p | 330p |
| 4116-200n | 85p | 80p |
| 6116 | 390p | 360p |
| 6522 | 300p | 280p |
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## CRYSTALS

| | | | |
|---|---|---|---|
| 32 768KH | 100 | 16 0MHz | 200 |
| 1MHz | 275 | 18 0MHz | 180 |
| 1 6MHz | 392 | 18 432M | 150 |
| 1 8MHz | 395 | 19 968M | 150 |
| 1 843M | 200 | 20 0MHz | 200 |
| 2 0MHz | 225 | 24 0MHz | 170 |
| 3 2768M | 150 | 24 930M | 325 |
| 3 57594 | 98 | 48 0M | 175 |
| 3 6864M | 300 | 100 0M | 375 |
| 4 0MHz | 150 | | |
| 4 433619 | 100 | | |
| 5 0MHz | 160 | | |
| 6 0MHz | 140 | | |
| 6 144MHz | 150 | | |
| 6 5536M | 200 | | |
| 7 0MHz | 150 | | |
| 7 168MHz | 160 | | |
| 7 68MHz | 200 | | |
| 8 0MHz | 150 | | |
| 9 0MHz | 200 | | |
| 9 375M | 350 | | |
| 10 0MHz | 175 | | |
| 10 7MHz | 150 | | |
| 10 24MHz | 200 | | |
| 12 0MHz | 175 | | |
| 12 528M | 300 | | |
| 14 31818 | 170 | | |

**WEMON**

**Watford's specially designed 4K Ultimate Monitor IC for UK101 & Superboard**

**Only £10.**

## IDC Connectors:

| Speed Block type | PCB Plug with latch Strt Pins | PCB Plug with latch Angle Pins | Female Header Socket | Unshrouded PCB Plugs Strt pins | Unshrouded PCB Plugs Angle pins |
|---|---|---|---|---|---|
| Two rows | 90p | 99p | 85p | 60p | 65p |
| 10 way | 130p | 150p | 110p | 70p | 78p |
| 16 way | 145p | 166p | 125p | 80p | 92p |
| 20 way | 175p | 200p | 150p | 95p | 110p |
| 26 way | 205p | 236p | 160p | 110p | 135p |
| 34 | 220p | 250p | 190p | 125p | 150p |
| 40 way | 235p | 270p | 200p | 150p | 175p |
| 50 way | | | | | |

**JUMPER LEADS** Ribbon Cable Assembly | DIL PLug (Headers)

Single Ended Lead 24" Long

| Length | 14pin | 16pin | 24pin | 40pin |
|---|---|---|---|---|
| 24" | 145p | 165p | 240p | 380p |

Double Ended Leads

| | | | | |
|---|---|---|---|---|
| 6" | 185p | 205p | 300p | 465p |
| 12" | 198p | 215p | 315p | 490p |
| 24" | 210p | 235p | 345p | 540p |
| 36" | 230p | 250p | 375p | 595p |

IDC FEMALE RECEPTACLE JUMPER LEADS

| 24" | 20way | 26way | 34way | 4way |
|---|---|---|---|---|
| 1end | 160p | 200p | 260p | 300p |
| 2end | 290 | 370p | 480p | 525p |

## DIL SOCKETS

| | Low Prof | Wire Wrap |
|---|---|---|
| 8pin | 8p | 25p |
| 14pin | 10p | 35p |
| 16pin | 10p | 42p |
| 18pin | 16p | 52p |
| 20pin | 22p | 60p |
| 22pin | 25p | 70p |
| 24pin | 25p | 70p |
| 28pin | 28p | 80p |
| 40pin | 30p | 99p |

## RIBBON CABLE

| Ways | Grey | Colour |
|---|---|---|
| | Price per Foot | |
| 10 | 12p | 22p |
| 16 | 25p | 32p |
| 20 | 25p | 40p |
| 26 | 35p | 52p |
| 34 | 48p | 60p |
| 40 | 55p | 70p |
| 60 | 75p | 115p |

## DIL PLUGS (Headers)

| | Solder | IDC |
|---|---|---|
| 14pin | 38p | 95p |
| 16pin | 42p | 100p |
| 24pin | 88p | 130p |
| 40pin | 195p | 218p |

## AMPHENOL PLUGS

| | |
|---|---|
| 24way IEEE | 575p |
| 36way Centronics | |
| Parallel | 550p |

## ZIF DIL SOCKETS

| | |
|---|---|
| 24way | 575p |
| 28way | 850p |
| 40way | 375p |

## VIDEO MONITORS

A choice of 5 attractively finished video monitors with a smoked antiglare display filter. Bandwidth >12MHZ; Res. > 750 lines, I/P 75Ω or high, 240V, 50HZ.

| | 9" | 12" |
|---|---|---|
| Black & White | £89 | |
| Green | £95 | £114 |
| Amber | £98 | £118 |

## EURO (DIN) CONNECTORS

| | Female Strt. Pins | Female Angle Pins | Male Strt. Pins | Male Angle Pins |
|---|---|---|---|---|
| DIN41617 31way 41612 A+B | 170p | — | — | 175p |
| 2×32way 41612 A+C | 285p | 325p | 220p | 295p |
| 2×32way 41612 A B C 3×32way | 300p | 325p | 240p | 300p |
| | 360p | 385p | 260p | 400p |

## EDGE CONNECTORS

| TWO ROWS | 1" | 156" |
|---|---|---|
| 2×10way | | 135p |
| 2×15way | | 140p |
| 2×18way | 180p | 145p |
| 2×22way | 199p | 200p |
| 2×23way | 195p | |
| 2×25way | 225p | |
| 2x28way | 210p | |
| 2×30way | 245p | |
| 2×36way | 295p | |
| 2×40way | 315p | |
| 2×43way | 395p | |

## D CONNECTORS: Miniature

**Male**

| | 9 way | 15 way | 25 way | 37 way |
|---|---|---|---|---|
| Solder | 80p | 110p | 160p | 250p |
| Angle | 160p | 210p | 250p | 355p |
| Pins | 120p | 130p | 195p | 295p |

**Female**

| | | | | |
|---|---|---|---|---|
| Solder | 110p | 160p | 210p | 350p |
| Angle | 165p | 215p | 290p | 440p |
| Pins | 150p | 180p | 240p | 420p |
| Covers | 100p | 95p | 100p | 110p |

IDC 25way 'D' plug 385p Skt 450p

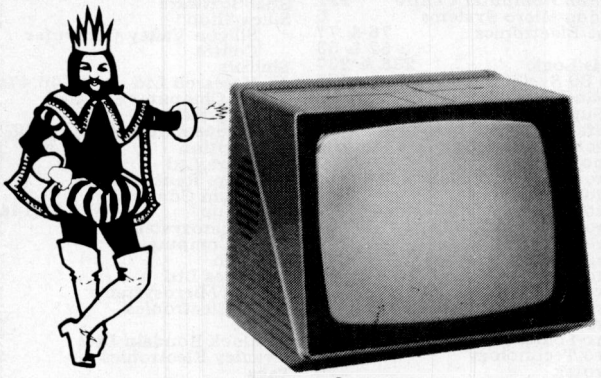
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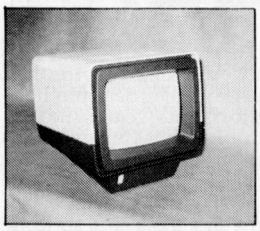
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**Tel: 01-874 2691**

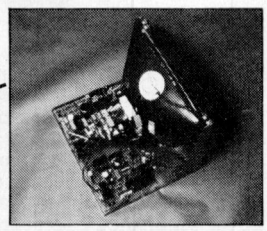
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Northamber 4
North Star Computers 264
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# CHIP CHAT

CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT

The 'state of the art' in micro technology in the USA seems to be getting itself into more and more of a state. For instance, an ad spotted recently in an American micro mag boasts 'Now you can use computer technology to search the Bible on any subject.' You see, some redneck fundamentalist computer freaks have put the King James Bible onto disk and are supplying it with a piece of look-up software called (believe it or not) The Word processor. Going to the other extreme, an outfit calling itself The Softcore Software Co is advertising a game (at least, we *think* it's a game) called 'Sewers of Moscow' — with sound!. . . While still on the subject of software trade names, the erstwhile editor of a certain other micro magazine, now a director of a software house, has christened his latest range of software 'Elephant Brand' — we wonder what colour it is (white, maybe?). . . While labouring through the Transaction File recently, an anonymous member of *PCW*'s staff discovered an ad from one W Packman. We presume he's no relation, and would like to warn him that he's making illegal use of a patented trademark. . . An IT report was dropped onto Editor Rodwell's desk not so long ago, the first item of which was a paragraph about computerised lavatory flushes, of all things. Apparently one of Reckitt & Colman's R&D labs has (quote) 'an international selection of lavatories flushing 24 hours a day at the command of a computer'. These flushes are performed by pneumatic controls which 'compress months of normal household use. . . into weeks or even days'. No suggestion is given as to why exactly there is a need to wear out all these cosmopolitan khazis, but it could be that Reckitt & Colman will produce a 'superlav' down which micro industry rubbish might be forever flushed at the command of a Cray 1. . . Caxton directors Tebbutt and Barrow were recently in a certain rather posh London hotel for the signing of their large deal with Osborne. Once names had been put to paper and all the bigwigs seen onto their plane, the aforementioned gentlemen decided to celebrate their new achievement with the most expensive cocktails on the tariff. They found their way to the bar, ordered their drinks, and then were told that alcohol was at that time not on sale to non-residents. Faced with the choice of waiting 25 minutes for a drink, going home for tea, or sipping fruit juice, they took the final option. Caxton's Cardbox deal with Osborne was therefore celebrated with fruit punch — complete with the little umbrellas, mermaids and maraschino cherries. . . Ever heard of the Apolo II? No? Nor had we, but it's upset Apple Computers. It's like this: Sunrise Computers of Taiwan took it upon itself to manufacture an exact copy of the Apple II — even down to the external design and the contents of the EPROMs — which was, for a while, available through CAB Trading BV in Holland. CAB Trading is, naturally, now forbidden to sell, exhibit, distribute or otherwise purvey this micro following a hearing in Amsterdam in which CAB's behaviour was held to be 'intolerable' and represented unfair competition to Apple. However, these legal proceedings seem to have gone a little far, as CAB is now also forbidden to use the words 'Apple II compatible' in its brochures and is also forbidden to use the trademark 'Apolo' in any respect as this 'constitutes a direct infringement of "Apple" '. Unfair's unfair, but the connection here seems a little obscure. . . For worried users of the VIC-20, we've heard from the top that, despite rumours to the contrary, the VIC will not be dropped in the wake of the Commodore 64. So if anyone tells you that the VIC-20 won't be on sale for much longer, you know what to do — tell them to VIC off. . .

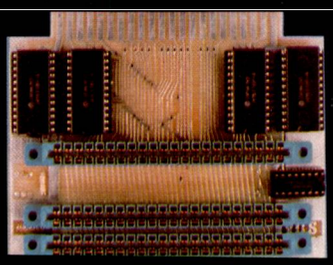
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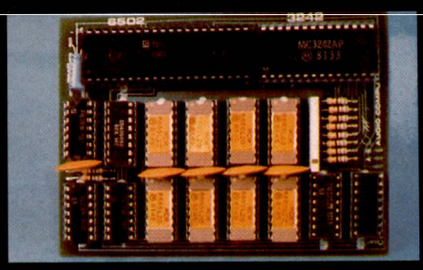
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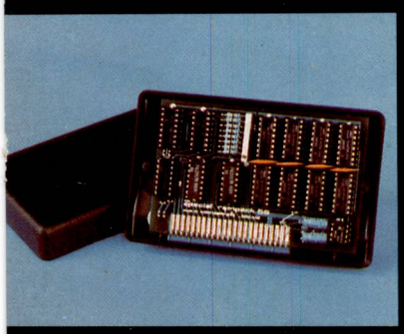
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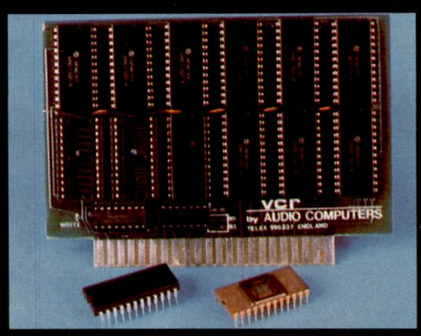
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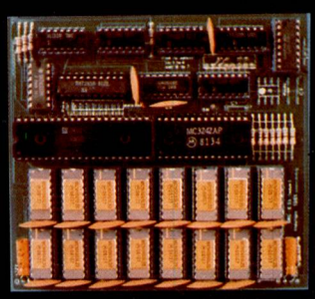
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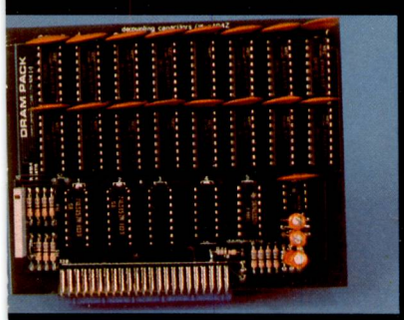
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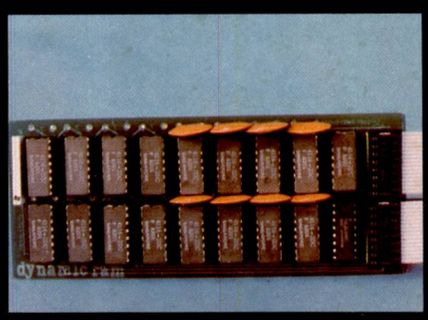
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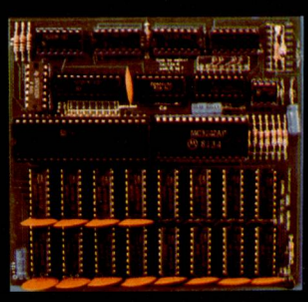


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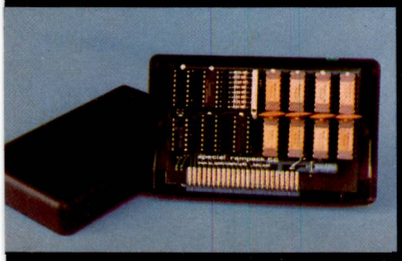
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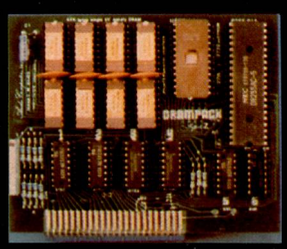
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